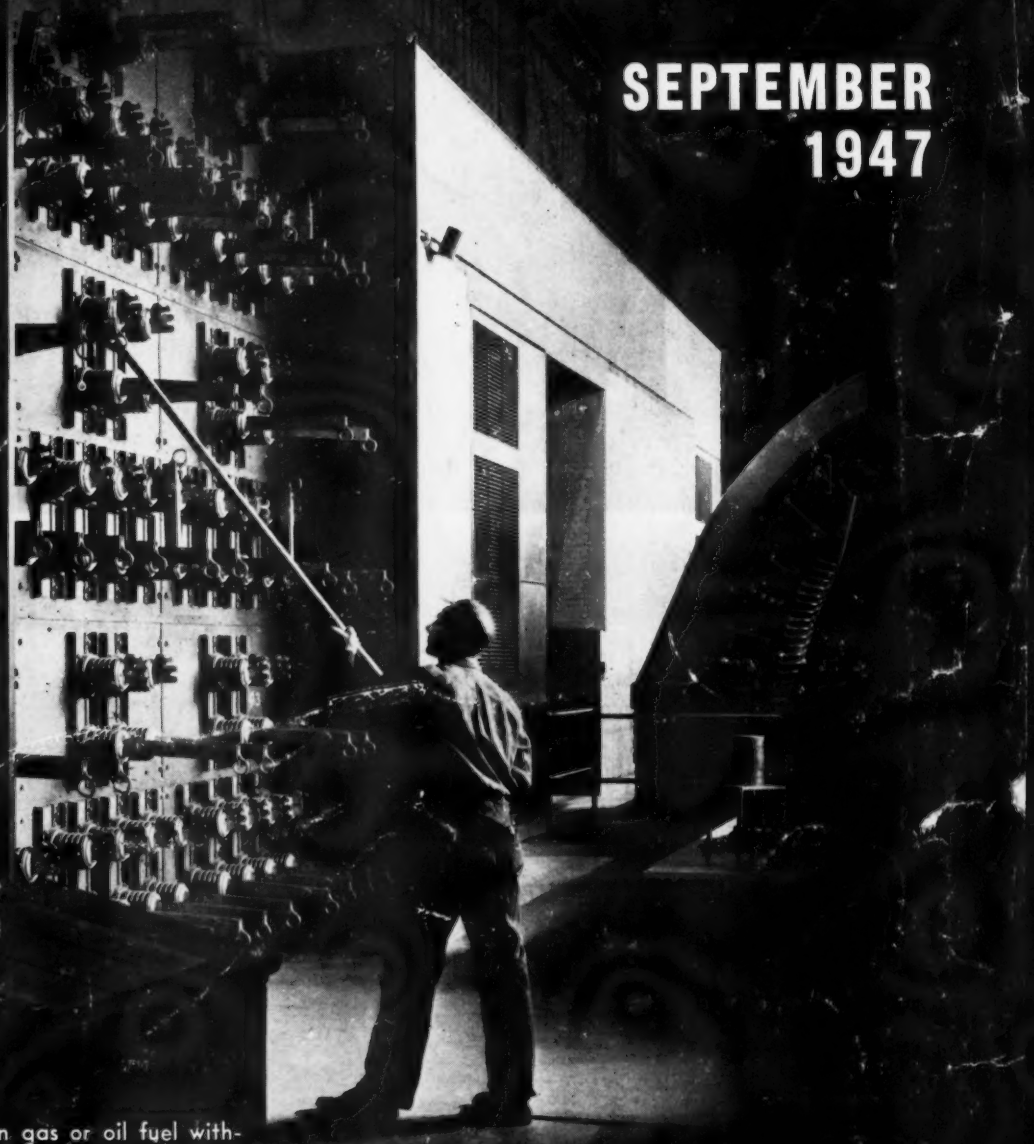
POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

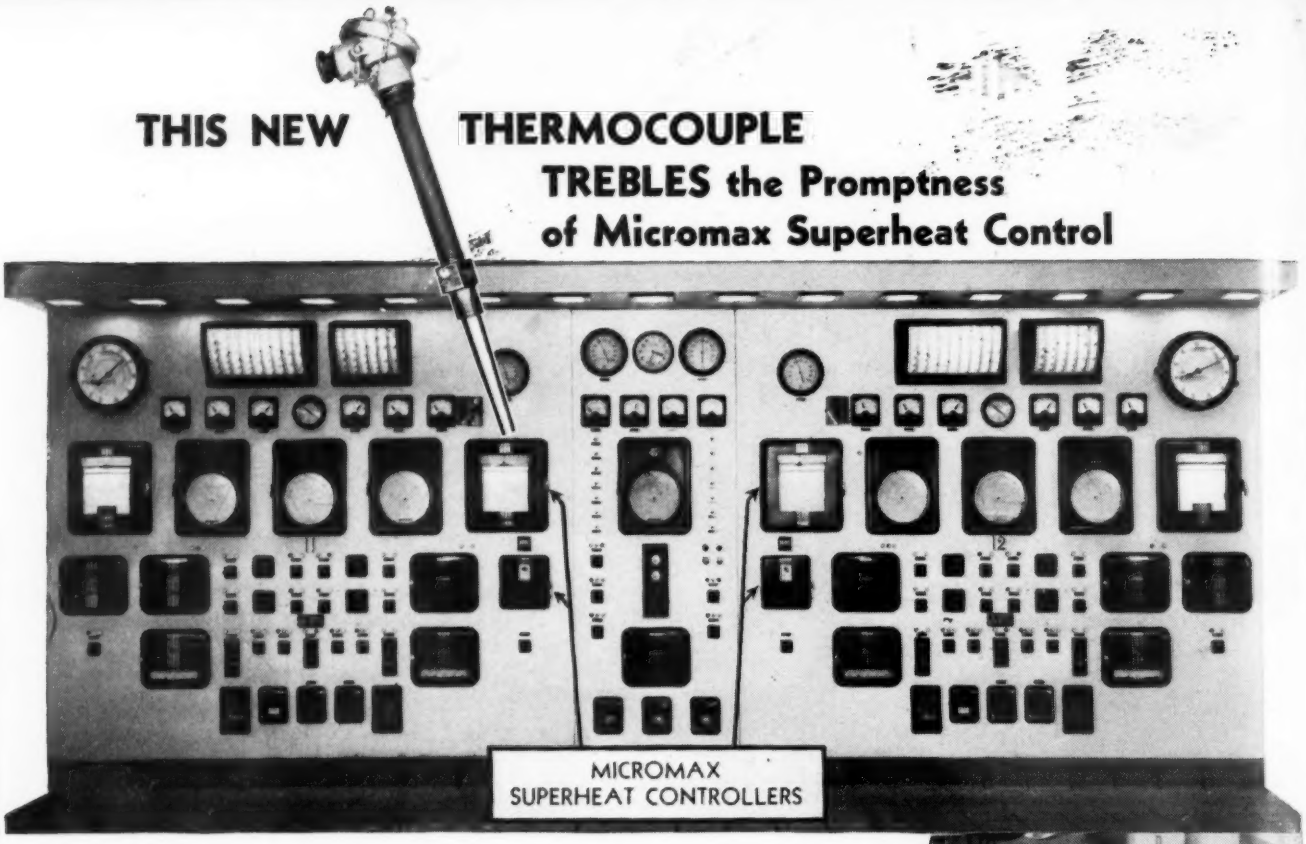
SEPTEMBER
1947



IN THIS ISSUE: How to burn gas or oil fuel without smoke, p 64; recent developments in large generators, p 69; report on German practices in feedwater treatment, p 72; how to select a control valve, p 103

TABLE OF CONTENTS Page 59

THIS NEW THERMOCOUPLE TREBLES the Promptness of Micromax Superheat Control



With recent design improvements, Micromax Electric Control now detects changes in superheat temperature more than three times as quickly as earlier installations. The advantage applies to all five conventional types of superheat control mechanism: by-pass damper, Attemperator, condenser, spray, or burner elevation.

Our New High-Speed Thermocouple is responsible for the greater speed of temperature detection. Any thermocouple has inherent advantages as a temperature detector for superheat, because its low mass makes it quickly responsive, and its small size permits easy installation in the steam line. Our new thermocouple, designed specifically for superheat control, exploits this fundamental advantage by construction which assures maximum heat transfer in minimum time.

Anticipating Control Action is another advantage of Micromax control for superheat. The inherent time lag between change in boiler load and corresponding change in steam temperature of course affects any control of the latter condition, but Micromax circumvents this effect by initiating its control action as soon as there is a change in the rate of air supply to the boiler. Further control action is then of course based on the thermocouple.

Many advantages of Micromax stem from the use of electric control throughout—from the detecting thermocouple to the positive-action drive unit

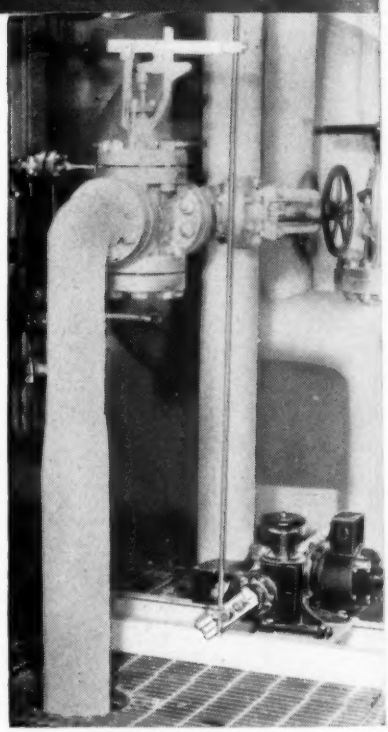
1) The only power used is electricity; the most dependable of power sources.

2) Dampers are positioned quickly and without over-shooting, because the motor-driven reduction gears move with accuracy in applying the large torques necessary to handle the friction load.

3) Dampers cannot move themselves in event of power failure; they are locked by the reduction-gear train.

4) Valves, dampers, etc. can be moved by handwheels if ever desired.

For analysis of any superheat instrumentation problem, consult an L&N engineer or send for Catalog N-33-163(1), as you prefer. Leeds & Northrup Co., 4910 Stenton Ave., Philadelphia 44, Pa.



Drive Unit for Micromax Electric Control of superheat by the Attemperator valve shown. This picture's small units and simple linkage show principle in all M.E.C. Controls whether larger or smaller.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

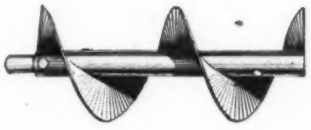
LEEDS & NORTHRUP CO.

Jrl. Ad N-33A-463(2)

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer" and "The Stationary Engineer"), September, 1947, Vol. 91, No. 9. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions $5 for one year, $8 for two years. 50c per copy. Canada $6 for one year, $9 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.

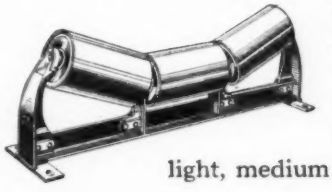
Move Bulk Materials *cheaper* the LINK-BELT way

. . . by Screw Conveyor — — —



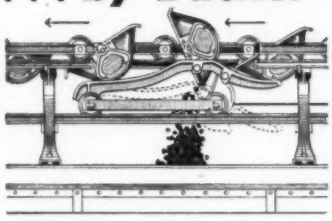
Link-Belt manufactures Helicoid, the original continuous flight screw conveyor. Other Link-Belt screw conveyor equipment includes sectional-flight, ribbon and paddle conveyors, as well as a complete line of accessories, such as collars, couplings, hangers, troughs, box ends, flanges, thrusts and drives.

. . . by Belt Conveyor — — —



Link-Belt makes all types of troughing, flat-roll, return and self-aligning idlers, including all accessories, such as trippers, belts, pulleys, bearings, take-ups, etc., for handling a wide range of materials, for light, medium and heavy-duty service.

. . . by Bucket Carrier — — —



There is a type of Link-Belt bucket carrier and bucket elevator for every service—horizontal, vertical or inclined—for handling all kinds of materials at desired capacities. Illustrated is the Peck Overlapping Pivoted Bucket Carrier.

. . . by Bulk-Flo Conveyor

Simple . . . Versatile . . . Compact . . . Enclosed. Economically handles flowable, granular, crushed, ground or pulverized materials of a non-abrasive, non-corrosive nature in a continuous mass, horizontally, vertically or on an incline, in a single unit. Bulk-Flo is easily adaptable to practically any surroundings.

LINK-BELT COMPANY, ***The Leading Manufacturer of Conveying and Mechanical Power Transmission Machinery***

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities. 10,600

• • •

Conveyors and elevators are called upon to do an endless variety of tasks. Each presents its own problems . . . each requires its own solution. From the design to the erection of your conveyor system . . . Link-Belt offer experience, backed by thousands of installations and foresight that has established their reputation as pioneers in the field of continuous movement of materials.

LINK-BELT

makes conveyors for every purpose —

. . . for lifting materials or lowering them —

. . . for moving parts and packaged materials —

. . . for conveying parts into machines for processing —

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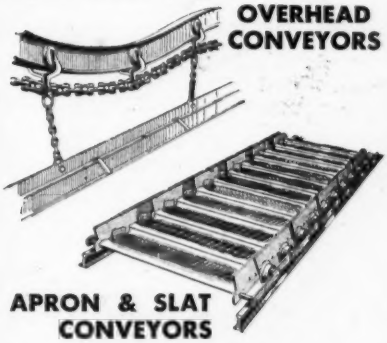
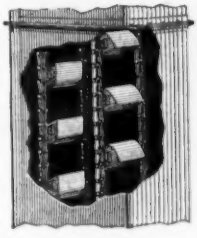
DETROIT

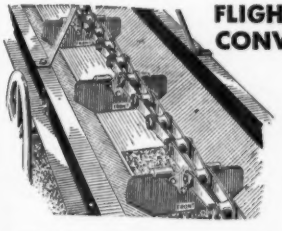


OVERHEAD CONVEYORS

APRON & SLAT CONVEYORS

BUCKET ELEVATORS



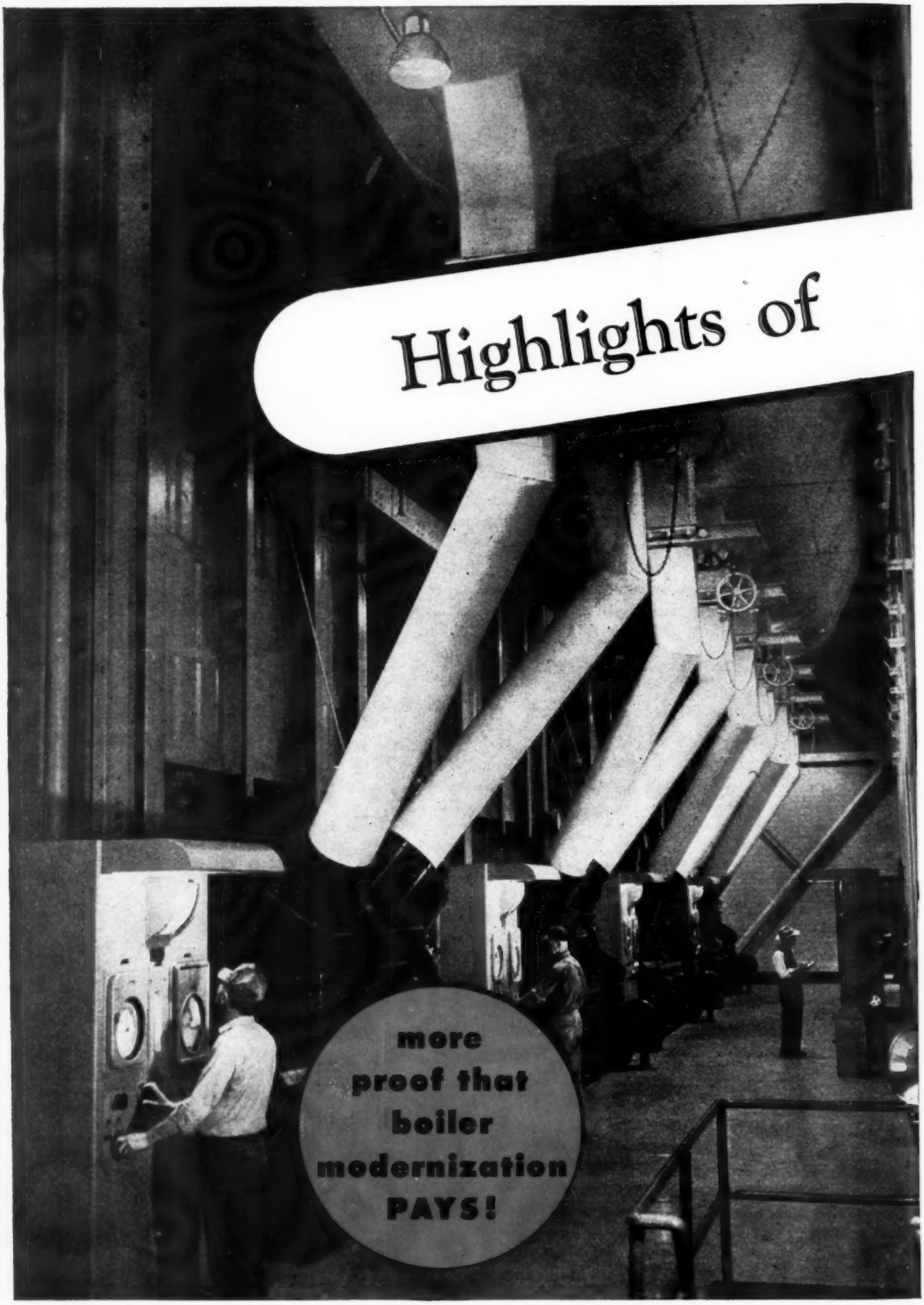


FLIGHT CONVEYORS

OSCILLATING-TROUGH CONVEYORS

LINK-BELT *Conveyors*

A TYPE FOR EVERY KIND OF MATERIALS HANDLING


Highlights of
more
proof that
boiler
modernization
PAYS!

Huntington!

more steam with fewer boilers and less fuel at lower cost

A notable example of direct benefits from modernization is an impressive new power plant, at the Chesapeake and Ohio Railway shops in Huntington, W. Va. Highlights are these:

- Four new Type H Stirling Boilers supply fifty per cent more steam than six old units replaced.
- New boilers burn all types of low; medium and high volatile bituminous coal available along the C&O lines—from over twenty different mines with widely varying ash content—without reducing steam capacity.
- New boilers will operate efficiently at 50 per cent above design capacity.
- Operating costs substantially reduced.

Selection of new B&W boilers for this modernization project was heavily influenced by the railway company's 35 years' satisfaction with the old units—also supplied by B&W.

Dollars-and-sense benefits usually follow in the footsteps of B&W's participation in any modernization plan. For B&W has equipment and ideas for producing low cost steam in *any* type of plant . . . *including yours.*

B&W

FOR POWER PLANTS — B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . . Air Heaters . . . Economizers . . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multifuel Burners . . . Chain-Grate Stokers . . . Stacks and Breechings . . . Seamless & Welded Tubes for All Pressure and Mechanical Applications . . . Refractories . . . Chemical Recovery Units . . . Alloy Castings.

★ ★ ★

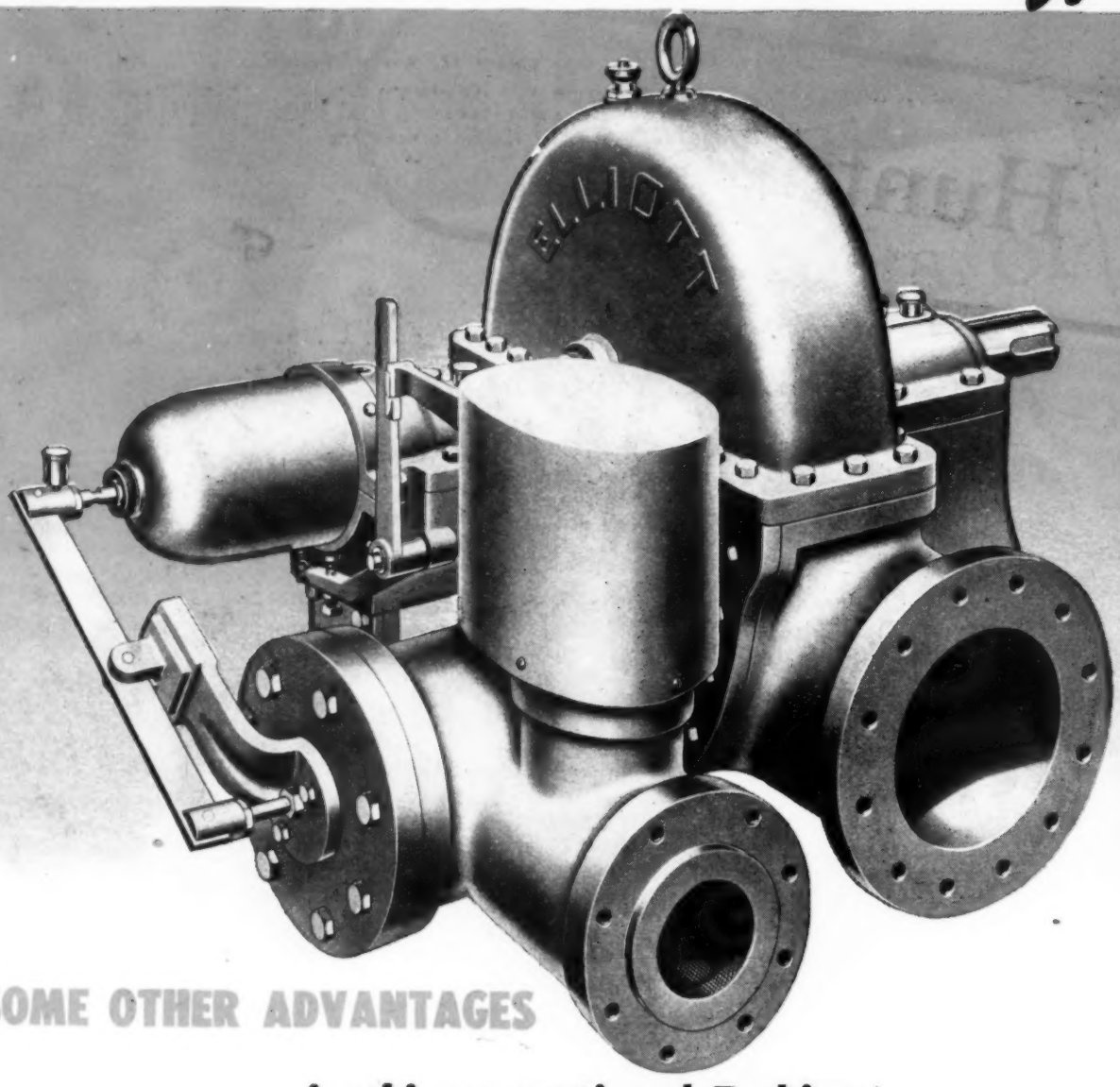
OTHER B&W PRODUCTS — Marine Boilers . . . Pressure Vessels . . . Process Equipment.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: ALLIANCE AND BARBERTON, O.; AUGUSTA, GA.

G356 T

The new "YR" Turbine offers "



SOME OTHER ADVANTAGES

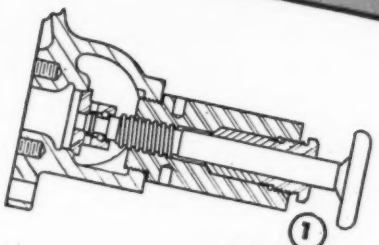
in this exceptional Turbine

Bearings protected by air-wall labyrinth seals . . . High speed liner type main bearings . . . Large oil reservoirs with effective cooling coils . . . Centerline support maintaining alignment unaffected by temperature of casing . . . Packing glands removable individually . . . Ball thrust bearing insuring correct rotor location . . . Completely sealed governor mechanism . . . Wide variety of governor types available . . . Right or left hand exhaust connection optional. Five frame sizes. Eight turbine types. Capacities, 1 to 2000 hp. Speeds, 800-6000 rpm. Back pressures to 250 psig. Write for Bulletin H-16 for full details.

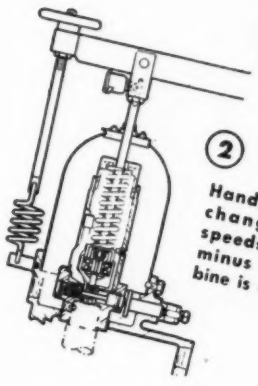
Elliott COMPANY

"STANDARDIZED FLEXIBILITY"

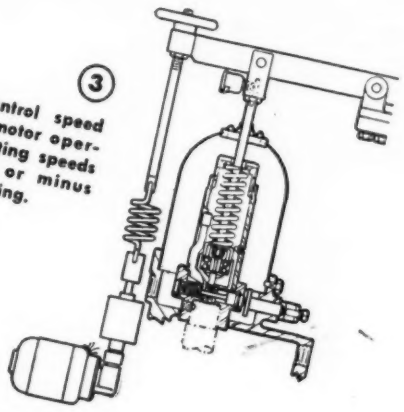
The new Elliott YR line of turbines is standardized—but with a wide range of permissible modifications, easily made, meeting almost any condition. Here are some of these modifications:



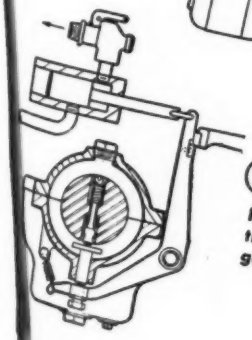
1. Two hand valves—controlling excess nozzling under part load, or under minimum steam conditions. On all frames.



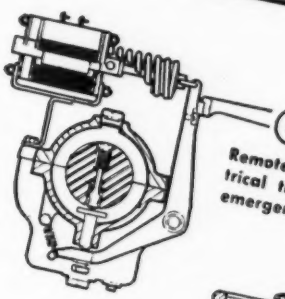
2. Hand-operated speed-changer, adjusting speeds within plus or minus 10% while turbine is operating.



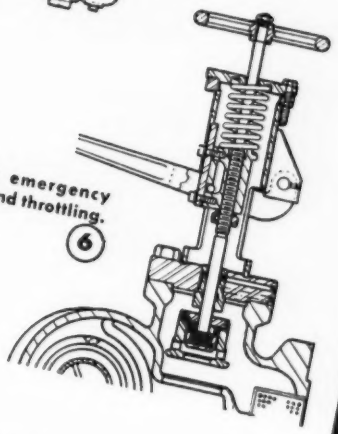
3. Remote control speed changer, motor operated, adjusting speeds 10% plus or minus while operating.



4. High exhaust pressure trip actuating emergency trip valve.

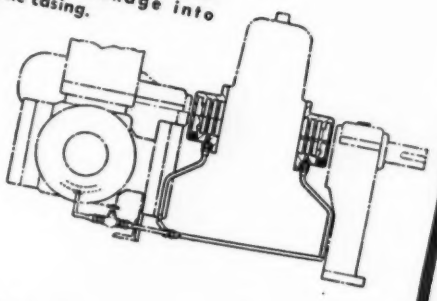


5. Remote control electrical trip actuating emergency trip valve.

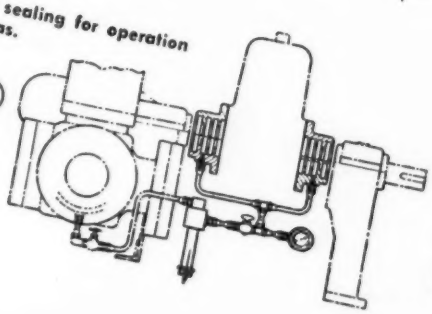


6. Throttling type emergency trip valve for hand throttling.

7. Gland seal piping for condensing operation—prevents air leakage into turbine casing.



8. Gland sealing for operation with gas.



Steam Turbine Department • JEANNETTE, PA.

Plants in: JEANNETTE, PA. • RIDGWAY, PA. • SPRINGFIELD, O. • NEWARK, N. J. • DISTRICT OFFICES IN PRINCIPAL CITIES

H-709

DIAMOND AUTOMATIC SEQUENTIAL

When a boiler is equipped with Diamond Automatic Sequential Air Puff Soot Blowers, none of the situations you see illustrated at the right can happen. In the first place, there is no attendant because the entire soot blowing system is operated by simply opening a valve on master controller or by pushing a "start" button on a program panel which can be a part of the boiler and turbine control board.

Then, being automatically controlled, the soot blowers always operate in the same sequence and with the same blowing time. No blower unit can be overlooked or incorrectly operated. Should it ever be found necessary to change the blowing sequence, it is easily accomplished by a simple change on the master controller.

The compressed air—having a greater density than steam—provides theoretically better cleaning. The air is discharged from the element nozzles in a series of short puffs with substantial pauses between. Spreading the cleaning cycle over a longer period of time permits use of a very small compressor.

This Diamond equipment has been in very successful central station use since 1940. For further information, write for Bulletin No. 956 which illustrates and describes an installation on a 900,000 lb/hr boiler in a modern eastern central station.

Other Features

SAVES LABOR

—no attendant needed to drain piping, warm it up and operate each individual blower.

NO FEED WATER MAKEUP

—using compressed air instead of steam.

SAVES FUEL

—uses only ⅓ to ⅔ of energy from coal pile that is needed for steam blowing.

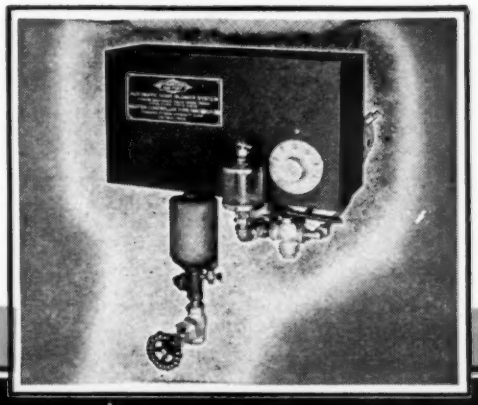
ELIMINATES STACK DISCHARGE NUISANCE

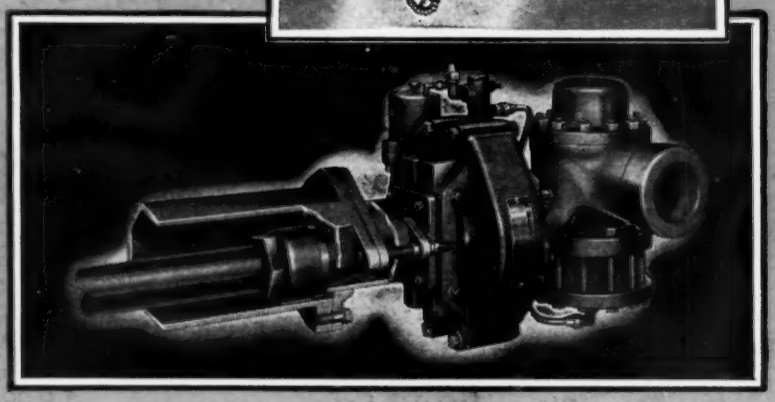
—intermittent operation expels soot from boiler in small quantities.

REDUCES MAINTENANCE

—experience on boilers in operation since 1940 proves maintenance unusually low.

(Right) Master Controller which automatically controls the sequence and blowing time of Diamond Air Puff Soot Blowers (see below) having elements permanently installed inside the setting.

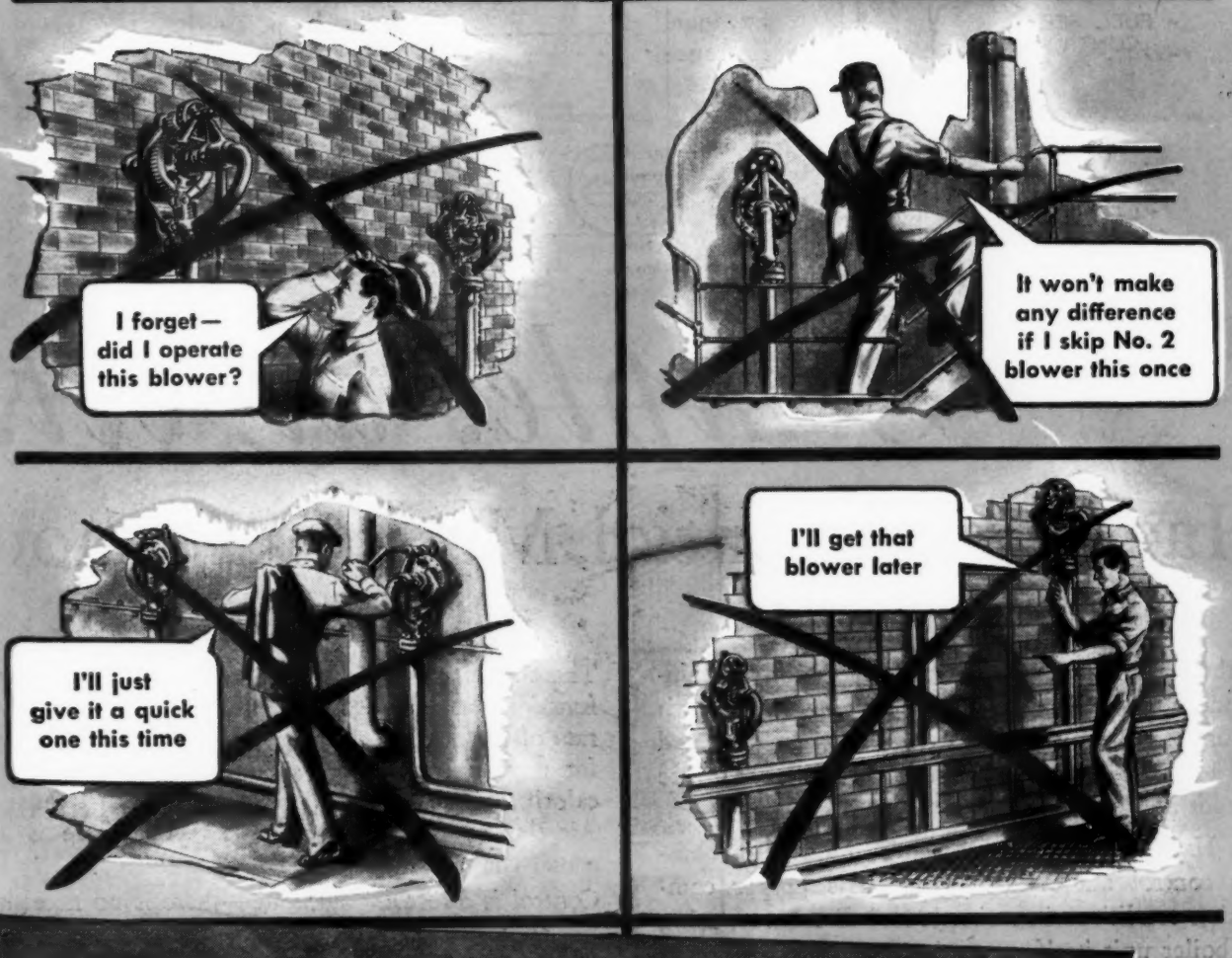




DIAMOND POWER

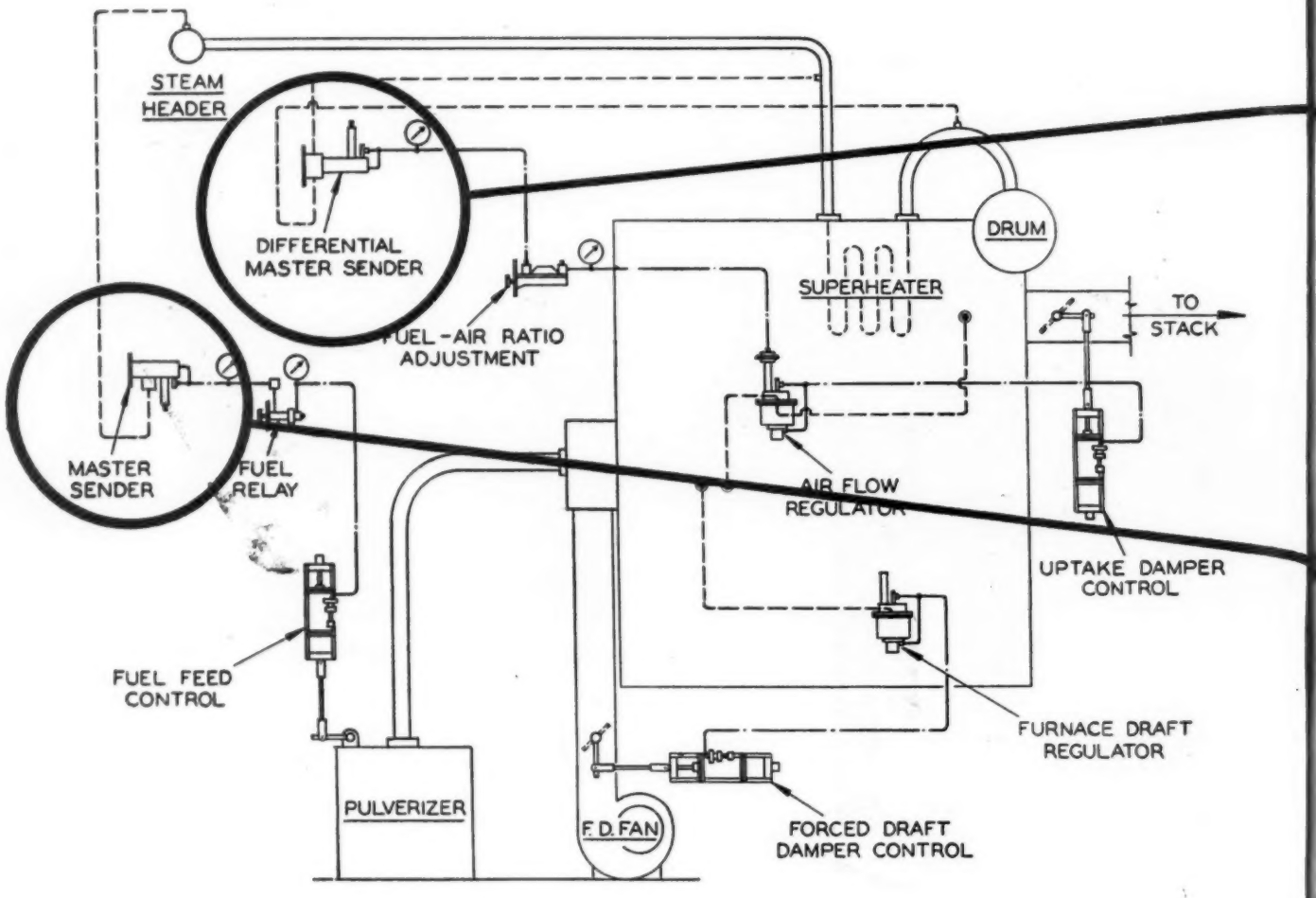
"Air Puff" SOOT BLOWING

Eliminates THE HUMAN ELEMENT and Assures CORRECT BOILER CLEANING


I forget— did I operate this blower?
It won't make any difference if I skip No. 2 blower this once
I'll just give it a quick one this time
I'll get that blower later

SPECIALTY CORP. DETROIT 31, MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario



Simple, direct,

Hagan Differential Master Method

In the firing of pulverized coal, the accurate maintenance of fuel-air ratio has been hampered by such factors as variation in the calorific value of coal, and coal feed mechanisms which are affected by moisture content and coal size.

The Hagan Differential Master method of combustion control automatically maintains proper combustion conditions in a simple and direct way, using the boiler unit itself as a calorimeter of heat input.

A Master Sender, sensitive to steam header pressure, controls the rate of fuel feed so that B.t.u. input is in accordance with demand.

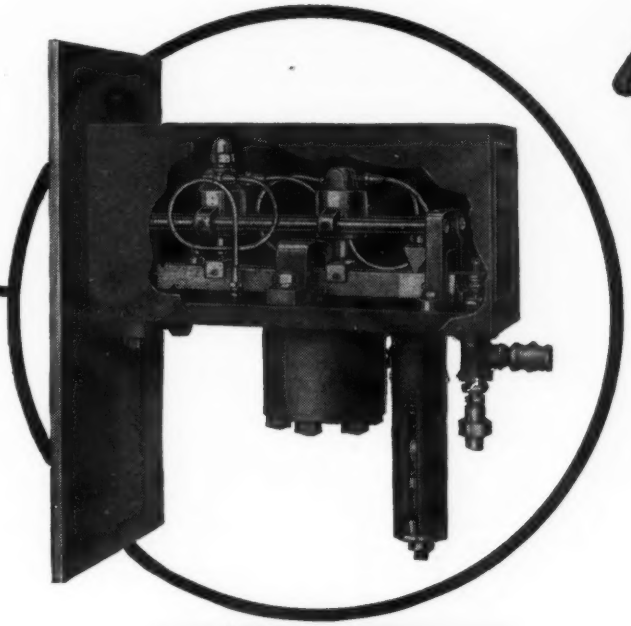
A Differential Master Sender, measuring steam flow, regulates air flow.

These units are not interconnected; each has its own function, and performs that function *directly*. The rate of fuel feed is changed instantly to compensate for any change in steam demand, or variation in calorific value of fuel or in feeder characteristic. Air, however, is changed only when there is an actual change in steam flow.

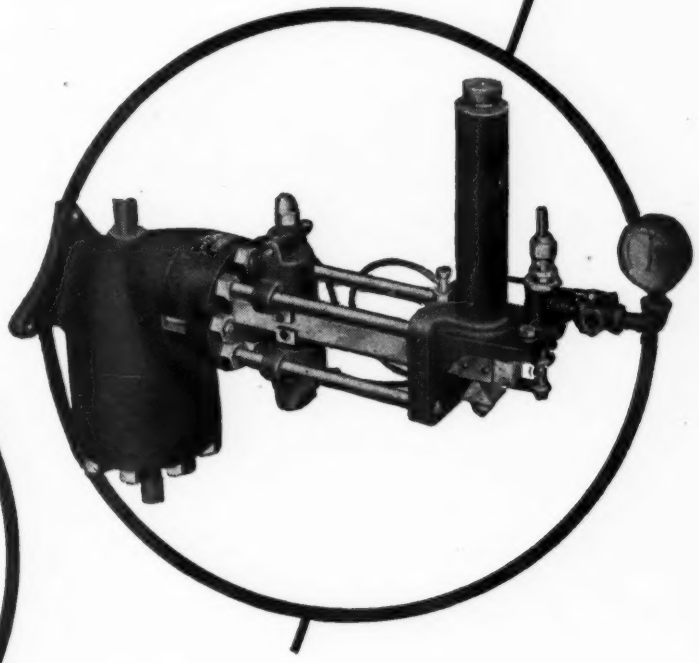
Control is direct and accurate—there is no necessity for approximate adjustment, to be corrected by a lagging corrector system.

Tested in Service

The Differential Master method has been thoroughly tested in service. In the past four years it has been applied to boilers burning oil, gas, and pulverized coal, and to multiple fuel boilers. Boiler sizes ranged



MASTER SENDER



DIFFERENTIAL MASTER SENDER

accurate

of automatic combustion control

from 30,000 lbs./hr. at 200 p.s.i. to 650,000 lbs./hr. at 1800 p.s.i. In every instance, results have been entirely satisfactory.

Substantial Fuel Savings

Where the differential master sender can be applied, it gives better control of combustion and substantial savings in fuel. Our engineers will be glad to discuss its possibilities in your plant.

Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.

HAGAN CORPORATION

HAGAN
HALL
BUROMIN
CALGON

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

The ambling rotation of this crude, "woman-power" mill poses no lubrication problems. But modern, precision-built turbine rotors, made to turn at thousands of r.p.m., must have precise lubrication. Use oils that prevent rust, oxidation and foam—*Texaco Regal Oils* (*R & O*).

PRIMITIVE LUBRICATION ...HERE

Precise Lubrication for Turbines...

TEXACO Regal Oils (*R & O*) are precisely the lubricants for modern turbines. They're the world-famous Texaco Regal Oils *made even better* by fortifying them with rust and oxidation inhibitors, and by special processing to prevent foaming.

Even with today's high speeds and close tolerances, turbines get full protection with *Texaco Regal Oils* (*R & O*). These exceptionally fine oils keep lubricating systems clean, free of rust and sludge. They do not foam. Their service life is extra long. Thus, they keep bearings at normal temperature, governors instantly responsive . . . assure high efficiency, fewer shutdowns for maintenance.

Texaco Regal Oils (*R & O*) meet the turbine oil specifications of all leading turbine manufacturers and those of the United States Navy.

With today's load curves frequently crowding capacity, margins for maintenance are slim—so effective lubrication of *all* your equipment is vital. Get Texaco Products and Lubrication Engineering Service from the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, New York.

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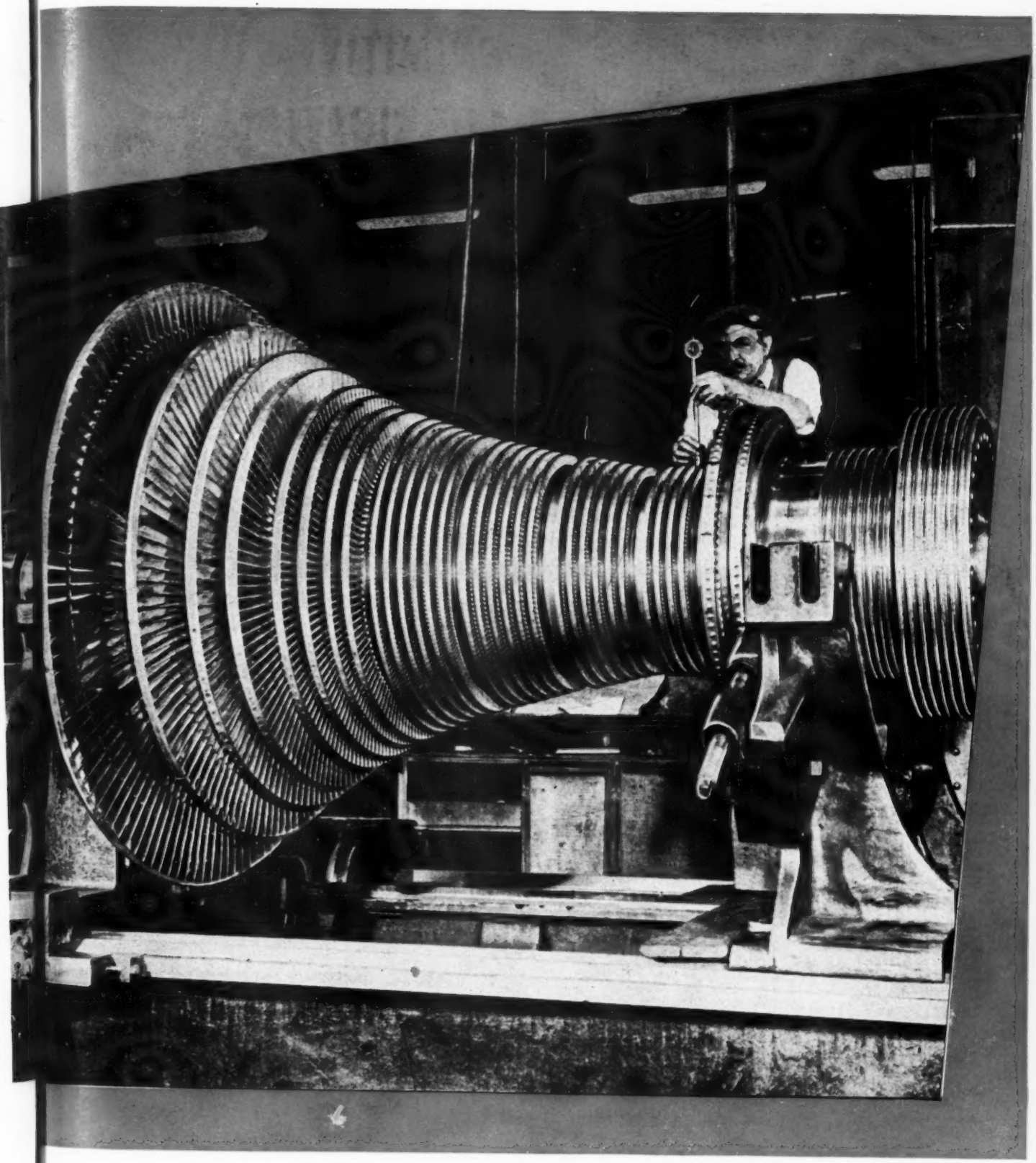
presents the
TONY MARTIN SHOW
every Sunday night.
See newspaper for
time and station.

TEXACO

TEXACO



REGAL OILS (R & O)

FOR ALL TURBINES

How Much Profit Do

$Fuel dollars wasted at the boiler cut your profits. If you are seeking ways to trim costs you may find your boiler room is the place to begin. Make certain you are getting co-ordinated boiler control. This way you can be sure you are getting maximum returns from your fuel dollars.

The Bailey co-ordinated boiler control system prevents wasted fuel. It increases safety of operation, improves continuity of service and reduces maintenance costs. Combustion, feedwater, steam temperature, heater levels, pump speed, and all other factors are co-ordinated to deliver maximum power at minimum cost.

The Bailey co-ordinated boiler control system pays its way in fuel saved because every system is engineered to the specific conditions under which it must operate. Like your power plant, it fits the job. To find out how Bailey controls can improve your boiler performance, we suggest that you—

Call This Man

He is a Bailey engineer. Back of him are years of experience in engineering control systems for fuel burning equipment of all types. He will work directly with you and your engineers in the design and application of the meters and controls required by your installation.

This engineering service is yours for the asking—available in more than 30 industrial areas throughout the United States and Canada.

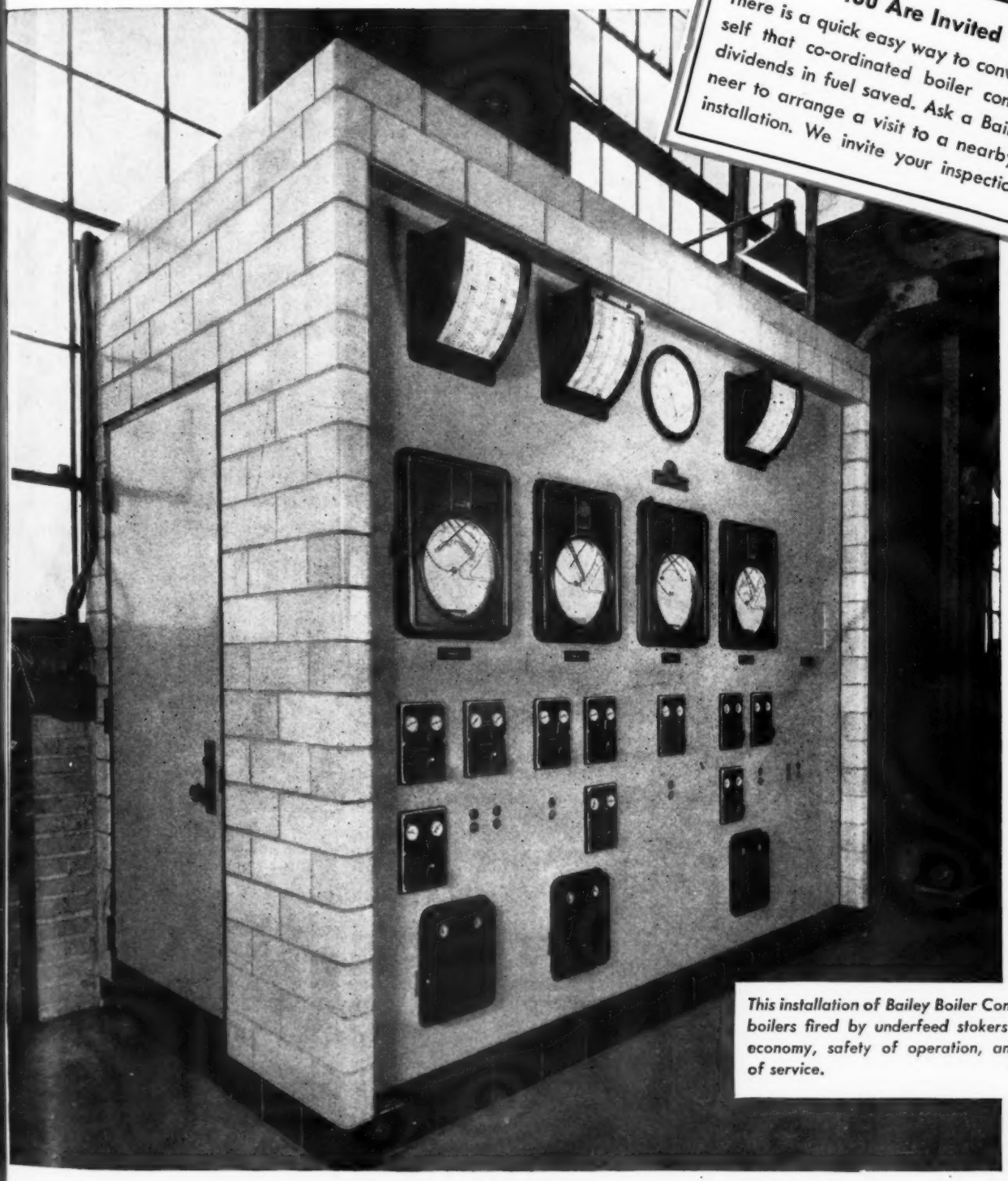
BAILEY METER COMPANY
1036 IVANHOE ROAD
CLEVELAND 10, OHIO

Controls FOR STEAM PLANTS
COMBUSTION • FEEDWATER • TEMPERATURE
PRESSURE • LIQUID LEVEL • FEED PUMPS

You BURN At Your BOILER?

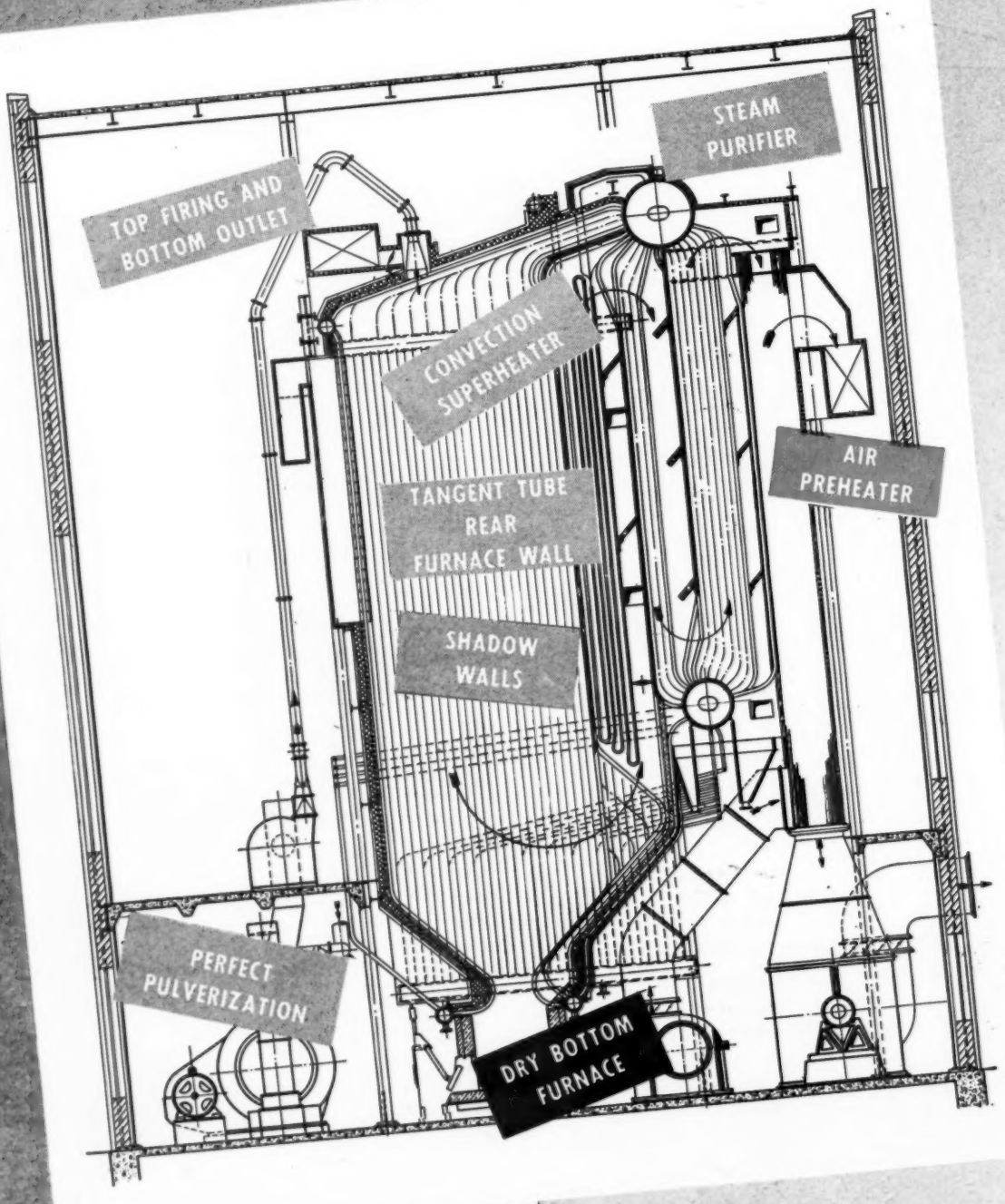
You Are Invited

There is a quick easy way to convince yourself that co-ordinated boiler control pays dividends in fuel saved. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We invite your inspection.



This installation of Bailey Boiler Control on three boilers fired by underfeed stokers insures fuel economy, safety of operation, and continuity of service.

KVS ENGINEERED



NO. 7 OF A SERIES

***See* AUGUST "POWER" *for description of* STEAM PURIFIERS**

PREHEATED AIR

. . . assures high overall efficiency *with* low exit gas temperature

KVS Air Preheaters are of the downdraft gas and cross counterflow air type. Gas passes inside the preheater tubes and air outside. Design is such as to minimize draft loss and pressure drop. Gases having high sulphur content can be safely handled. An all metal, all welded casing is employed to assure tightness.

These units are designed and built for single or multi-pass gas and air. A liberally dimensioned soot hopper is provided at the turn of the gases and arranged to collect the fine precipitate which is removed by an automatic ash handling system.

Ducts for connecting fans to preheater and from preheater to burners and pulverizers are of proper size and proportion for the service and are designed to accommodate expansion and application of insulation.

All other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.

KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance-proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK USA · MFG. & ENG. CORP.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

ARMY E NAVY

2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

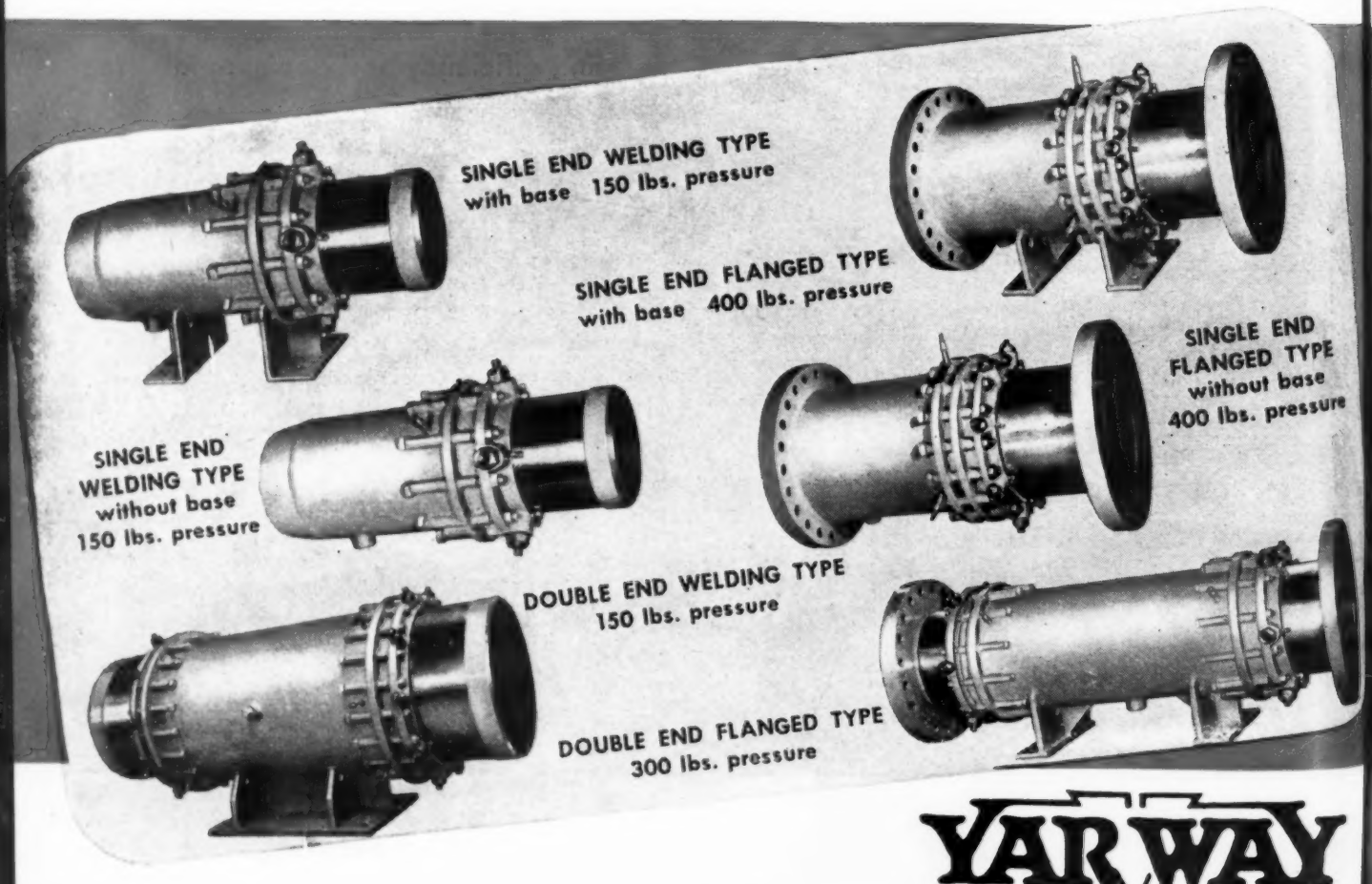
CANADA • ENGLAND • FRANCE • AUSTRALIA

Stop ...shutdown losses and production delays

Look...at the record low maintenance costs

Listen ...to what users say about...

"GUN-PAKT"



YARWAY

JOINTS

YARWAY "GUN-PAKT" EXPANSION JOINTS

Yarway "Gun-Pakt" Expansion Joints are more than an improved expansion joint . . . they are a revolutionary idea that has won the enthusiastic approval of steamplant engineers from coast to coast.

These are the expansion joints that can be serviced *under full steam* pressure. Insert a packing plug, twist a wrench, and the job is done. It's as simple as that! Special Alemite fittings provide for proper lubrication. "Gun-Pakt" means the end of costly shutdown losses and production delays.

"Gun-Pakt" also means minimum maintenance. One user of 66 "Gun-Pakt" joints kept a record for 14 years—the average cost of materials to service joints was only 65 cents per year per joint! Another user, a large utility, maintains over 100 Yarway "Gun-Pakt" joints at a cost of only $1.50 per month for packing for all joints.

No wonder plants like one of Detroit's largest motor car manufacturers are saying, "We want 'Gun-Pakt' joints and nothing else!"

For the full story on Yarway "Gun-Pakt" Expansion Joints, write for Bulletin EJ-1911.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

GUN-PAKT EXPANSION JOINTS

BOILER CONTROLS • INSTRUMENTS • PROCESS CONTROLS

The Republic Flow Meters Co. offers a complete manufacturing and engineering service in the field of measurement and control. We will be glad to co-operate with you in the solution of any metering or control problem, whether it involves a single instrument or the automatic control of an entire process or plant.

Republic engineers, in co-operation with your own engineers, will be glad to study your problem and make recommendations as to the most practical solution. Your inquiries will involve no obligation on your part.

BOILER CONTROLS

For All Types of Boilers

Republic offers a centralized, automatic system for controlling steam pressure, combustion, furnace pressure, excess pressure, boiler water level, etc.

Automatically regulates the fuel and air imput to a boiler in measured proportions and in a fixed ratio for the entire load range. Available for all sizes of boilers and all types of fuel firing.

FLOW METERS

Electrical and Mechanical

Republic electrical type remote reading flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for line pressures up to 10,000 p. s. i. and for all ranges of differential pressures.

Mechanical ring-balance meters are built for static pressures up to 2500 p.s.i. and to operate on differentials as low as 3 in. of water.

BOILER METERS

Record Steam Flow—Air Flow

The Republic boiler meter records simultaneously on one chart the steam flow from the boiler and the rate of air flow to the furnace for combustion.

The air flow pen is adjusted to record coincident with the steam flow pen when the furnace is receiving the proper amount of air for maximum combustion efficiency.

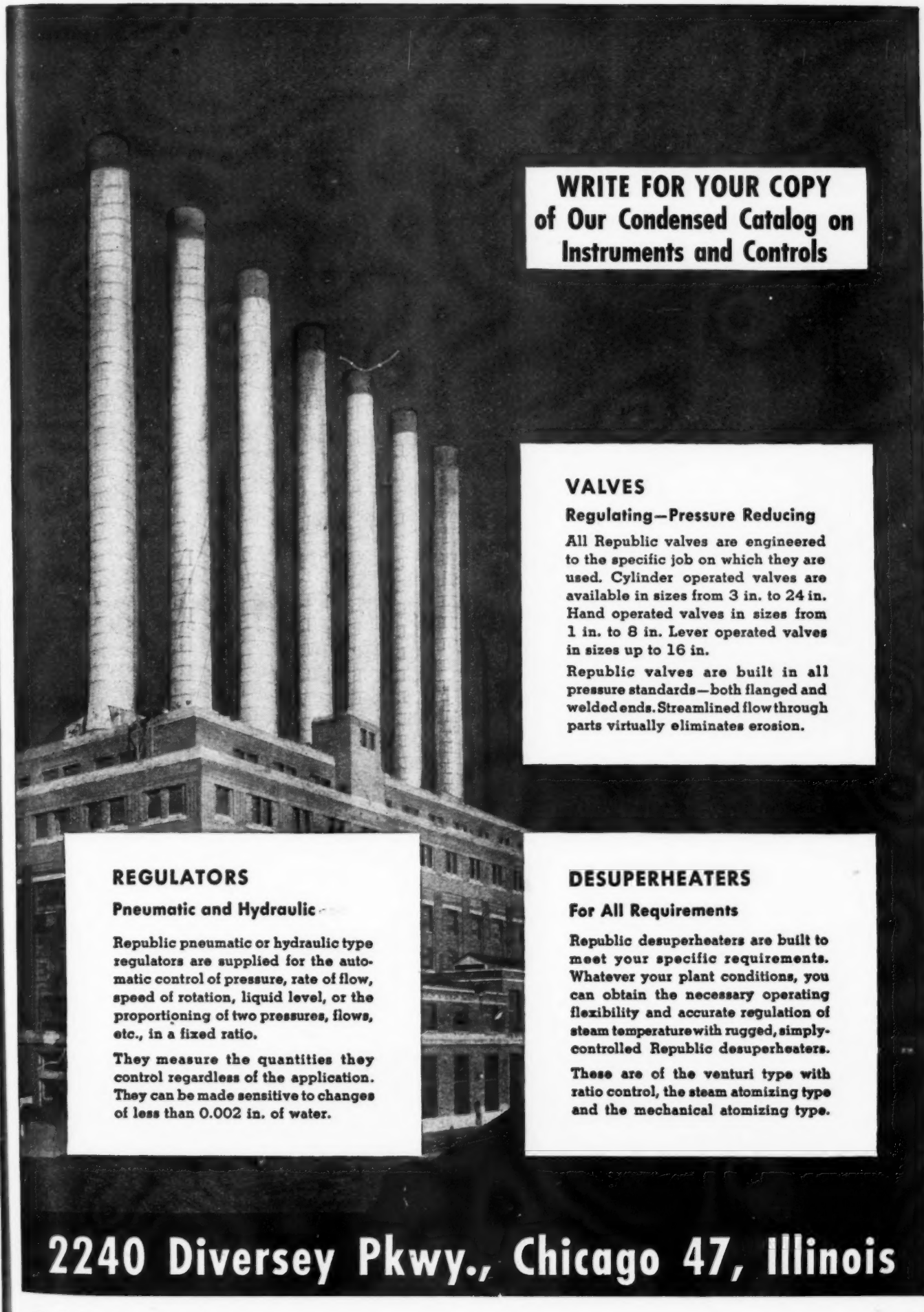
PNEUMATIC TRANSMITTERS

For Measurement and Control

Republic pneumatic transmitters are devices for converting process variables, such as flow, liquid level, pressure or liquid density, into air pressures which vary proportionally with the process variables.

These air pressures can be used as the measuring impulse for the actuation of an automatic controller or a direct reading recorder.

REPUBLIC FLOW METERS CO.



WRITE FOR YOUR COPY
of Our Condensed Catalog on Instruments and Controls

VALVES

Regulating—Pressure Reducing

All Republic valves are engineered to the specific job on which they are used. Cylinder operated valves are available in sizes from 3 in. to 24 in. Hand operated valves in sizes from 1 in. to 8 in. Lever operated valves in sizes up to 16 in.

Republic valves are built in all pressure standards—both flanged and welded ends. Streamlined flow through parts virtually eliminates erosion.

REGULATORS

Pneumatic and Hydraulic

Republic pneumatic or hydraulic type regulators are supplied for the automatic control of pressure, rate of flow, speed of rotation, liquid level, or the proportioning of two pressures, flows, etc., in a fixed ratio.

They measure the quantities they control regardless of the application. They can be made sensitive to changes of less than 0.002 in. of water.

DESUPERHEATERS

For All Requirements

Republic desuperheaters are built to meet your specific requirements. Whatever your plant conditions, you can obtain the necessary operating flexibility and accurate regulation of steam temperature with rugged, simply-controlled Republic desuperheaters.

These are of the venturi type with ratio control, the steam atomizing type and the mechanical atomizing type.

2240 Diversey Pkwy., Chicago 47, Illinois

Get Double Protection Against Motor Burnouts from Overloads or Single Phasing—

By Installing

FUSETRONS

"In Seven Years We have Not Lost a Motor Due to Single Phasing When Protected with Fusetrons

"City water pumps are driven by four 20 h.p. three phase 440 volt 24 ampere motors. The motors are equipped with overload relays.

"In the first three years after these motors were installed in 1935, two were burned out from single phasing.

"Mr. S. O. Petterson, our City Water Works Electrician, in August, 1938, installed 30 ampere Fusetrons to protect these motors.

"On September 5, 1938, a severe electrical storm hit this area, causing many phase failures in power lines. Three of the four pump motors at Alderwood Station were operating at the time. Each single phased and each came off the line with no damage, other than the blowing of the Fusetrons. When the Fusetrons were replaced, everything worked perfectly as though there had been no storm. In the seven years since then we have not lost a single one of these motors.

"The next day after the storm, I said to Mr. Petterson, 'Those gadgets you call Fusetrons are certainly the finest protection ever devised for motors. They saved us over $300.00 last night!' "

Herbert J. Carson
Asst. Supt. Water Department
City of Everett, Washington

Here's Proof from a Fusetron User—

BUSS

At Little or No Extra Cost — Fusetrons Provide *Extra Safety* for Motors

IT'S TRUE that most large motors are protected with thermal cutouts or overload relays—BUT experience shows that such mechanical devices sometimes fail to operate, and you may burn out a motor.

At little or *no extra cost* Fusetrons, on normal installations, eliminate this danger by giving your motors DOUBLE PROTECTION against burnout from single phasing or any dangerous overload. You simply replace fuses used for short-circuit protection with Fusetrons of motor-running protection size. Then, you get short-circuit protection plus motor-running protection.

Why Fusetrons Give Motor-Burnout Protection

Fusetrons have a tremendous time-lag which ordinary fuses and circuit breakers do not have. This means that Fusetrons can be used in a size close to the actual running current of the motor, while ordinary fuses and circuit breakers must be installed oversize to hold the motor starting current.

Therefore, ordinary fuses or circuit breakers can give only short-circuit protection. They cannot protect either the motor or the starter against burnout.

But, on normal installations, when Fusetrons of proper size are used, any current dangerously in excess of normal motor running current will cause them to open. Thus, they protect should other overload devices fail — they give the motor *double protection* against burnout.

Provide the Simplest Way To Prevent Damage from Single Phasing.

When single phasing occurs, the current flowing through the motor, and through the Fusetron, in the remaining phase increases nearly 100%. This 100% overload will open a Fusetron of motor-running protection size and stop the flow of current before the motor can be damaged.

WHY THIS EXTRA SAFETY FOR YOUR MOTORS COSTS YOU LITTLE OR NOTHING

Large size fuses are replaced with SMALLER size Fusetrons. This means a step down in the price range.

For example: The lowest cost 100 amp. 250 volt fuse costs approximately $0.40. A 60 amp. Fusetron to replace it costs about $0.36 — (BUSS Fuse Reducers to make the change possible cost but little and need never be replaced.)

That is why you need not worry about the cost of replacing fuses with Fusetrons even though installing Fusetrons means that you REDUCE MANY, MANY TIMES THE CHANCE OF HAVING A MOTOR BURN OUT.

On new installations you ACTUALLY SAVE MONEY because proper size switches or panels are installed, instead of oversize equipment needed to take fuses large enough to hold motor starting current. The smaller size Fusetrons further reduce costs.

What is the FUSETRON?

- The Fusetron is a DUAL element device — A Fuse to which is added a Thermal Cutout.
- The result is a fuse with tremendous time-lag and much less electrical resistance.
- Fusetrons have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.
- Fusetrons are made to same dimensions as ordinary fuses and fit all standard fuse holders.
- They are obtainable in all sizes from 1/10 to 600 ampere — in both 250 and 600 volt types.
- Also obtainable in plug type and tamper-resisting type (Fustats) for 125 volt circuits.
- Their cost is surprisingly low.

Fusetrons Provide Many Kinds of Protection Not Provided by Ordinary Protective Devices — if Installed throughout the Electrical System.

☆ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads. ★ Give Thermal Protection to Panelboards and Switches. ★ Prevent Needless Blows caused by Heating in Panels and Switches. ★ Permit use of larger motor or adding more motors on circuit WITHOUT installing larger switch or panel. ★ On new installations, PROPER size switches and panels can be used instead of OVERSIZE. ★ Protect motors against burnout. ★ Give DOUBLE protection to large motors. ★ Provide simplest way to stop burnouts from single phasing. ★ Make burnout protection of SMALL motors simple and inexpensive. ★ Protect coils, Transformers and Solenoids against burnout.

Get All The Facts . . .

Get Better Protection — Send the Coupon Now

Even one lost motor or one needless shutdown or one destroyed panel may cost you more than replacing every fuse with a Fusetron. Don't risk such losses. Change over the whole plant to Fusetrons.

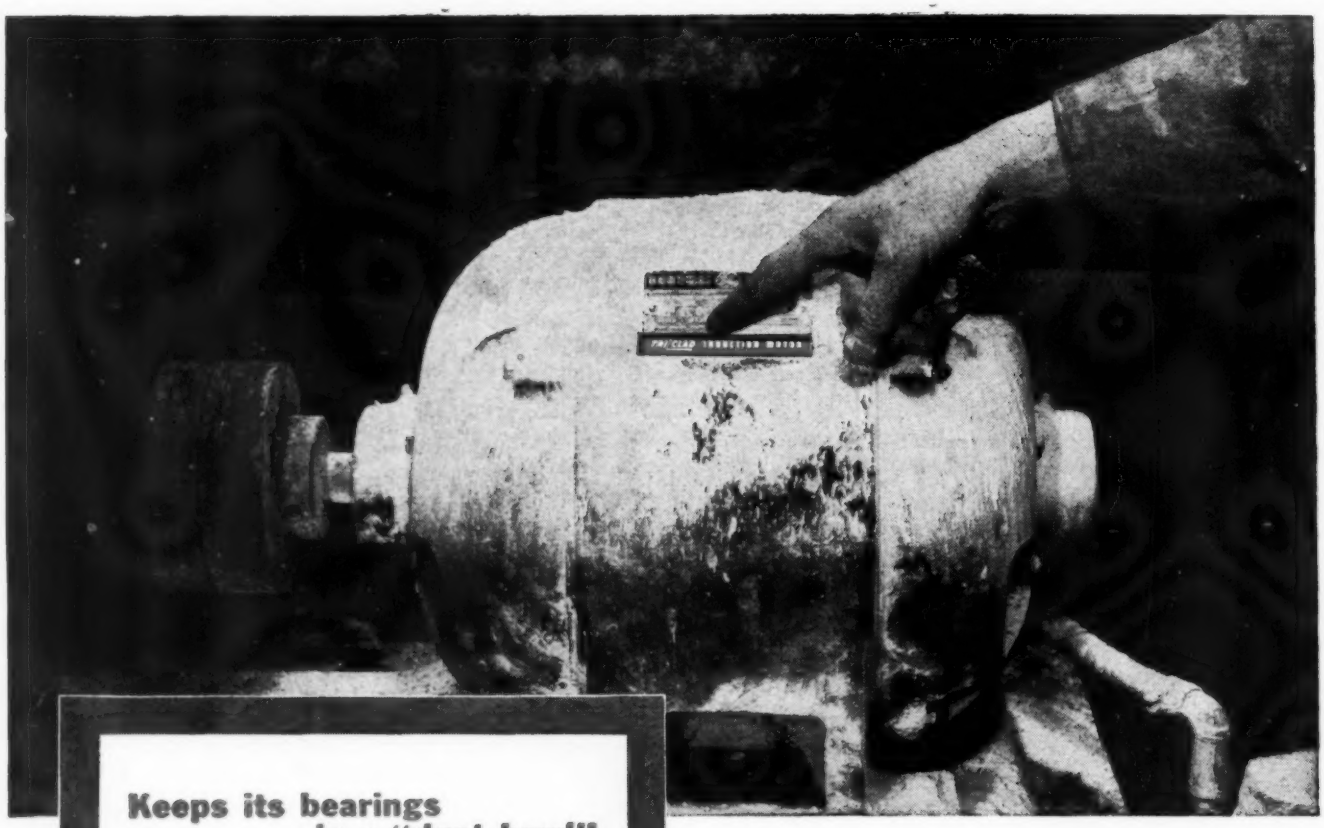
Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)
Please send me complete facts about BUSS Fusetrons.

Name_____
Title_____
Company_____
Address_____
City_____ State_____
947

FUSETRONS

SOLD THROUGH WHOLESALERS

ON 1,220,000



Keeps its bearings *in a "dust bowl"*

Ordinarily, we wouldn't recommend that you use an open motor on a job like this. This Tri-Clad motor drives a boiler-feed pump in the National Gypsum Company plant at Clarence Center, N. Y. The air surrounding the motor is constantly filled with gypsum dust which must be kept out of the bearings. And it *has* been kept out of the bearings of this Tri-Clad motor, thanks to its specially designed bearing housing and seals. We believe that the Tri-Clad motor you see here proves that even where dust, moisture, or some other hazard is extremely severe for open-motor applications, the extra protection afforded by Tri-Clad motor construction results in longer motor life and lower upkeep.

and now—THE TOUGHEST TRI/CLAD YET

REG. U.S. PAT. OFF.

Newest addition to the Tri-Clad motor family is the Tri-Clad totally enclosed, fan-cooled motor. It is designed for use in adverse atmospheres—in iron dust, out-of-doors, in hazardous areas, and chemical atmospheres. Available in both standard and explosion-proof types, this Tri-Clad motor gives you these important construction features:

- **A cast-iron, double-wall frame which completely encloses and protects the windings and punchings.**
- **A nonshrinking compound around motor leads which protects motor interior from dust and moisture.**
- **A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.**

MOTORS

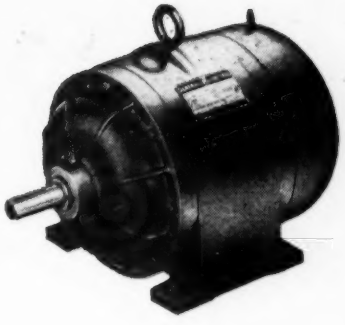
TRI CLAD

THE SYMBOL OF

EXTRA PROTECTION

Announcement of the Tri-Clad motor, back in 1940, ushered in a new concept of general-purpose motor design. Substantially increased horsepower-per-frame-size, was one feature. Smarter appearance was another. But what really sold more than a million Tri-Clad motors is the *extra protection* we built into them.

Often operating under conditions no general-purpose motor should be asked to meet, Tri-Clad motors built up an enviable record of war-time service. Today, with the "family" including dripproof motors, vertical motors, gear-motors, capacitor-motors, and totally enclosed motors, the Tri-Clad motor is, more than ever, the motor that means basic protection, dependable performance, and minimum upkeep. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



EXTRA PROTECTION... AGAINST PHYSICAL DAMAGE!

Rigid cast-iron frame and end shields protect vital motor parts from external abuse and prevent resonance. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast iron also gives you tight, *metal-to-metal* fits between end shields and frame.

EXTRA PROTECTION... AGAINST ELECTRICAL BREAKDOWN!

Motor windings of Formex* wire, together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly — motor stays young for years and years!

EXTRA PROTECTION... AGAINST OPERATING WEAR AND TEAR!

Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

*Trade-mark reg. U. S. Pat. Off.

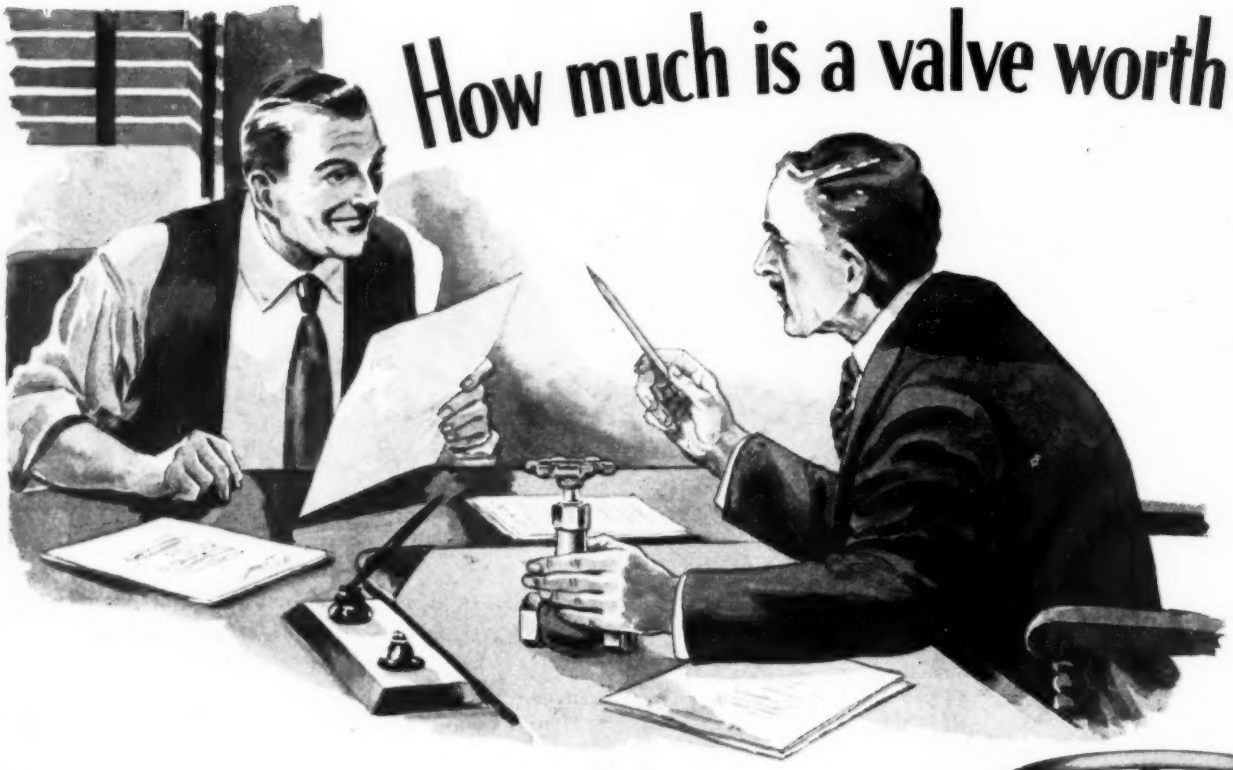
TRI CLAD
REG. U.S. PAT. OFF.
MOTORS

- OPEN (DRIPPROOF)
- TOTALLY ENCLOSED
- EXPLOSION-PROOF

GENERAL ELECTRIC

700—225

How much is a valve worth?

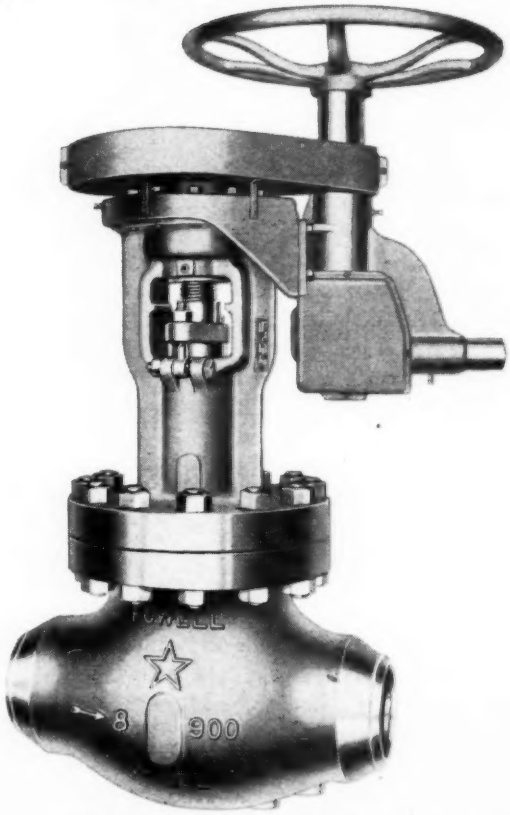


The $64 question is not "what is the price of the valve," but "how much is it worth?"

And the measure of its worth is "will it do the job, how long will it give satisfactory service, and what will be the ultimate cost of maintenance?" For in addition to the cost of labor and materials in maintaining a valve, don't lose sight of the serious loss of production while a valve is "down" for repairs or replacement.

The Powell Line is so complete* that there's always a Powell Valve specifically adapted to do the job. Powell Valves are noted for long-life, satisfactory service. Powell Valves are designed to reduce maintenance and shut downs to a minimum.

*The Powell Line includes Bronze and Iron Valves of every required type, design, size and pressure; Cast Steel Valves of every type, in pressure classes from 150 to 2500 pounds; and, for the chemical and process industries, a complete line of Corrosion-Resistant Valves in the widest range of pure metals and alloys ever used in making valves.



Class 900-pound, 8", Cast Steel Non-return Globe Valve with welding ends. Spur gear operated.

The Wm. Powell Co., Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL

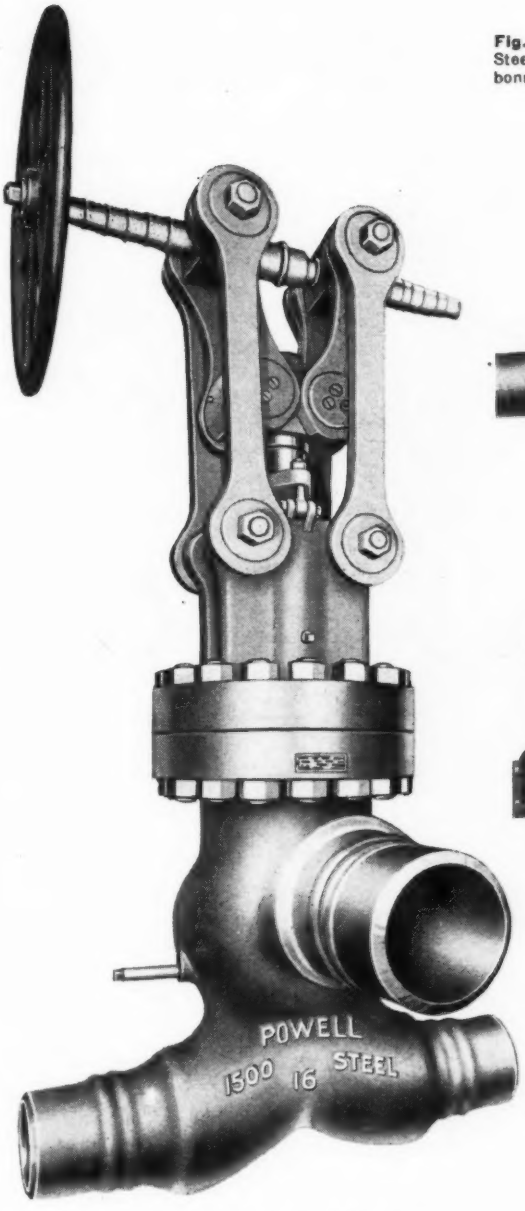


Fig. 1393—Class 1500-pound Cast Steel Non-return Angle Valve with welding ends, said to be one of the largest of its kind ever built. Has 16" outlet and two 12" inlets. Because of special streamline designing the pressure drop through the valve is reduced to a minimum. The valve is toggle operated.

Fig. 1314-A—Class 1500-pound Steel "Y" Valve. Has integral bonnet and welding ends.

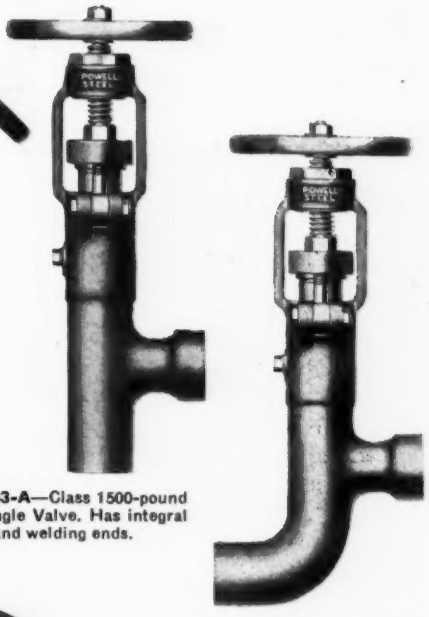


Fig. 1333-A—Class 1500-pound Steel Angle Valve. Has integral bonnet and welding ends.

Fig. 1331-A—Class 1500-pound Steel offset Globe Valve. Has integral bonnet and welding ends.

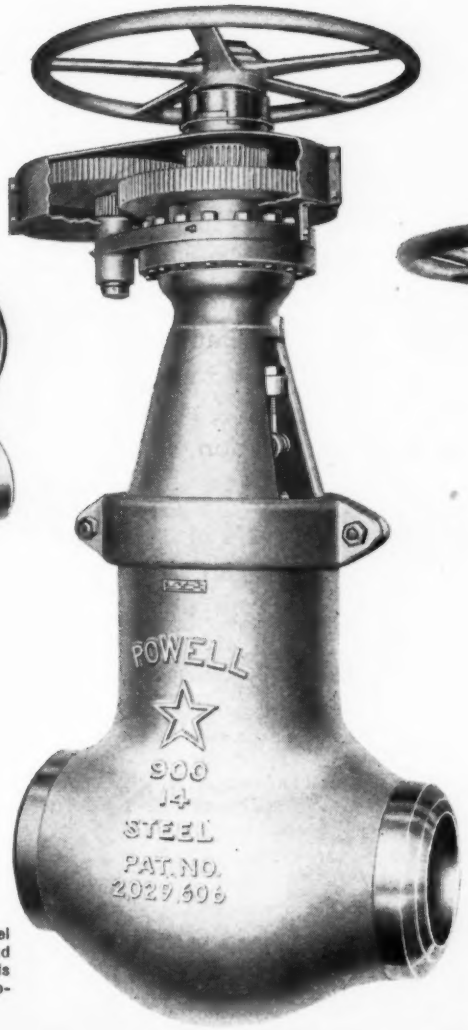


Fig. 19084—Class 900-pound, 14", Cast Steel Non-return Globe Valve with welding ends and pressure seal bonnet. Internal pressure seals body-bonnet joint. Compound spur gearing provides easy operation.

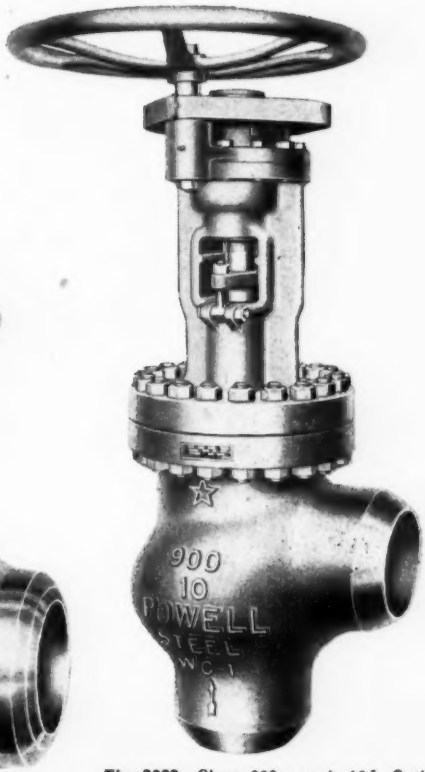
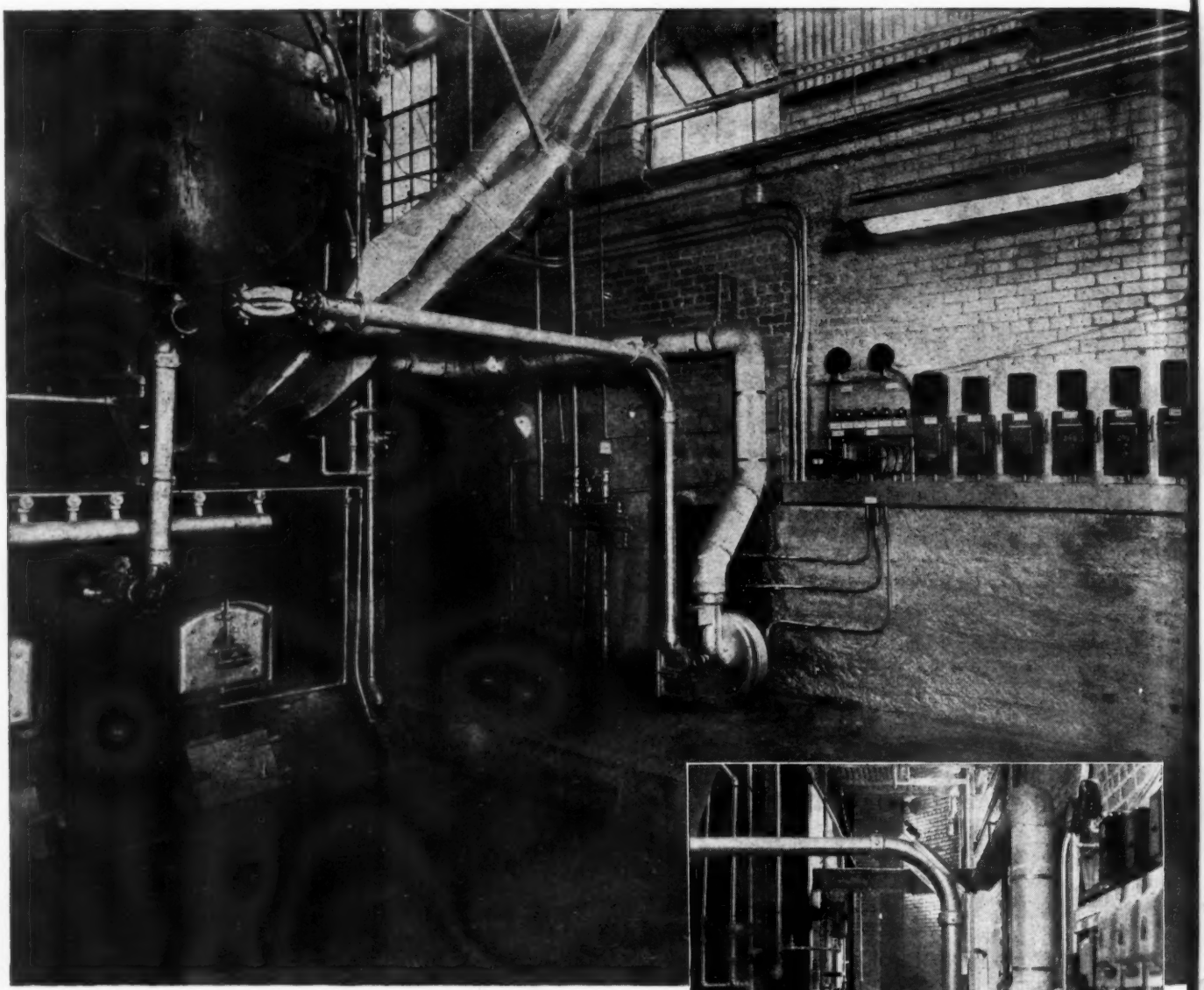
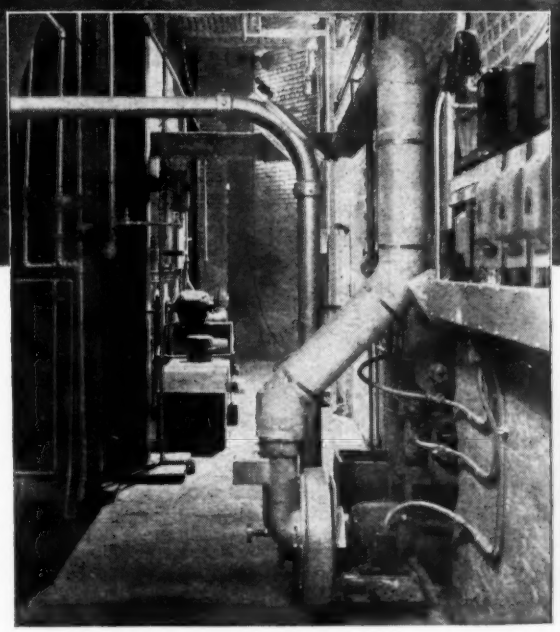


Fig. 9089—Class 900-pound, 10", Cast Steel Non-return Angle Valve with welding ends. Spur gear operated.

VALVES

Iron Fireman Stoker





Iron Fireman Pneumatic Spreader Stoker in the boiler room of Hickory Manufacturing Company, Hickory, N. C.

Smoke nuisance has been abated and greater cleanliness has been achieved since installation of Iron Fireman Pneumatic Spreader stoker at the Hickory Manufacturing Co., Hickory, N.C. Wood waste, gravity-fed into the combustion chamber through the large pipes shown above, supplements coal fuel, blown on a stream of pre-heated air through the smaller pipe entering the face of the combustion chamber. Coal is sprayed evenly on a special grate by adjustable nozzle, giving a shallow, fast-burning fuel bed. (Right) Insulated pipe passes pre-heated air from combustion chamber into coal conveyor mechanism, drying damp coal and raising its temperature for quick ignition.

HEAVY DUTY STOKERS AND OIL BURNERS

IRON

THE IRON FIREMAN

Saves $9,600 Yearly

What was once a problem is now a profit

THE disposal of wood-waste was once a problem at the Hickory Manufacturing Co., makers of high grade bedroom furniture at Hickory, N.C. Their hand-fired boiler plant, using coal in conjunction with a bare 15% of their wood refuse, generated only half of their needed power. Purchased power supplied the deficiency.

During the summer of 1945 an Iron Fireman Pneumatic Spreader stoker was installed. Using the existing wood-conveying system, this Iron Fireman utilized 100% of the wood waste as a supplement to coal. All power requirements were fulfilled, purchase of outside power was eliminated, savings of $800 monthly over former power costs were realized.

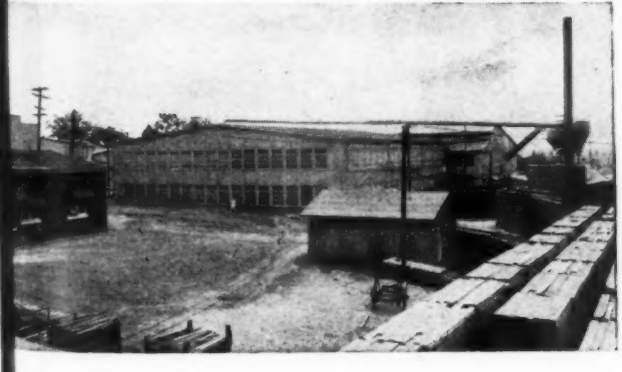
Adaptability is an Iron Fireman feature

Ready adaptability, as exemplified in this unusual wood-coal combination, has always been a valuable feature of the Iron Fireman Pneumatic Spreader stoker. Its pneumatic coal conveying system can easily be adapted to space requirements without costly alterations. Iron Fireman's instant responsiveness makes it highly adaptable to applications which have extreme variations in load demands.

Designs are proportioned to meet the maximum steam demand, insuring an ample steam supply at peak ratings. Fuel and air feed-rate is constantly regulated for efficient combustion under all load requirements. Fuel-air ratio is self-adjusting.

Iron Fireman's high combustion efficiency not only saves tonnage, but permits use of low-grade coals, such as the smaller sizes and low ash fusion coals. It is adaptable to all ranks of bituminous coal, also sub-bituminous and lignite, permitting the use of the type of coal that is supplied most economically in the local market.

View of Plant Exterior—Hickory Mfg. Co., Hickory, N. C.



Low maintenance costs

All Iron Fireman mechanism is readily accessible for inspection and maintenance. Lower maintenance costs result from the separation of all moving parts from the direct heat of the combustion chamber.

Are YOU getting maximum boiler room power?

You may not be getting full power returns from your steam plant. Iron Fireman technicians, at no cost or obligation to you, will make an accurate, impartial survey of your boiler room. For free survey or illustrated literature write to Iron Fireman Manufacturing Company, 3105 West 106th Street, Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada. Dealers everywhere.

IRON FIREMAN

FOR POWER, PROCESSING AND HEATING

Simple to understand . . . Positive in operation . . .

HAYS
INDUSTRIAL
INSTRUMENTS

This is THE MODERN SYSTEM

because it's Electrical

It's smart, profitable common sense to operate an automatic combustion control system electrically. It's the "coming thing" —and coming fast; just as electricity's usefulness is rapidly increasing for operating many kinds of industrial equipment—stokers, pulverizers, fans, blowers and the like. The reasons are obvious: the inherent advantages of electricity—simplicity, positive and instantaneous action, and fool-proof dependability.

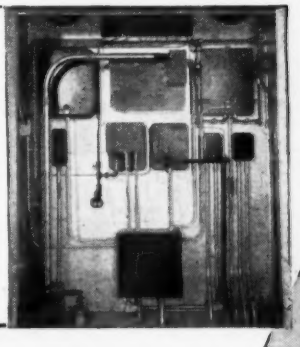
HAYS gives you those practical advantages—a wholly electrical system of centralized control, distinguished for sound engineering, simple design and finest workmanship. Sensitive contacts are controlled by enclosed mercury switches—no moisture, dust nor other foreign material to cause sticking, chatter and excessive wear. Installation is easy, maintenance is reduced to simplest routine. Adjustments are made direct—not dependent on air pressures, oil pressures and numerous valve mechanisms characteristic of non-electrical design.

For full details of this ***Method as Modern as Tomorrow*** send for Bulletin 47-605—containing schematic drawings of 14 typical illustrations. Write for it.

The HAYS CORP., MICHIGAN CITY, IND.

ELECTRICITY Makes Possible Orderly Design

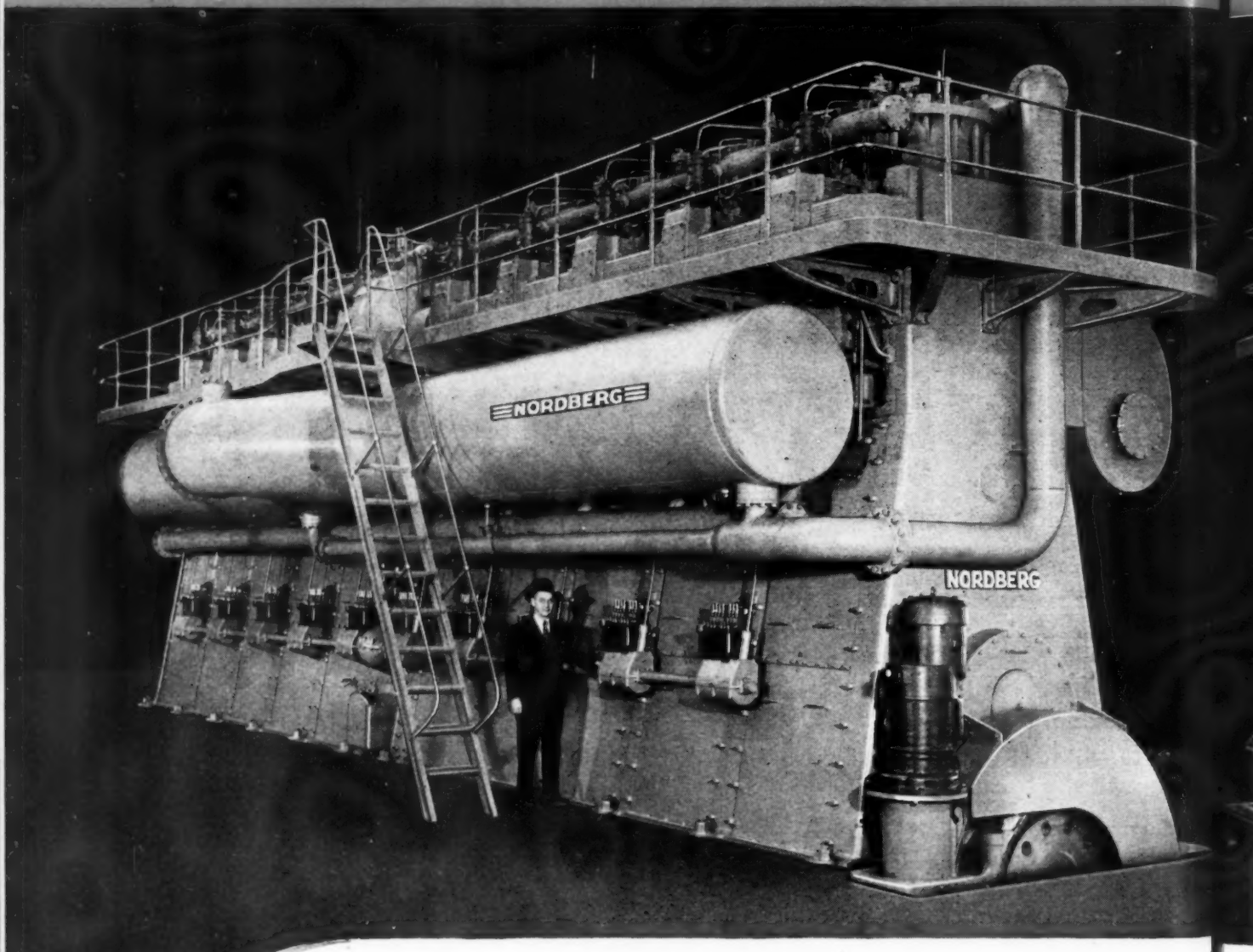
The use of electricity makes possible a neat, orderly, simplified arragement of the centralized panel as this rear view illustrates. Hays panels are tailormade at the Hays factory and come completely wired ready to be connected to the steam generator control system. All wiring is housed in thin walled conduits accurately formed and assembled to fit each instrument and controller. By the Hays method of construction, installation is simplified and operation of the entire control system easily understood by the operators.



Automatic COMBUSTION CONTROL

INDUSTRIAL CONTROL · FLOWMETERS · GAS ANALYZERS · DRAFT GAGES · CO_2 RECORDERS

MOST POWERFUL

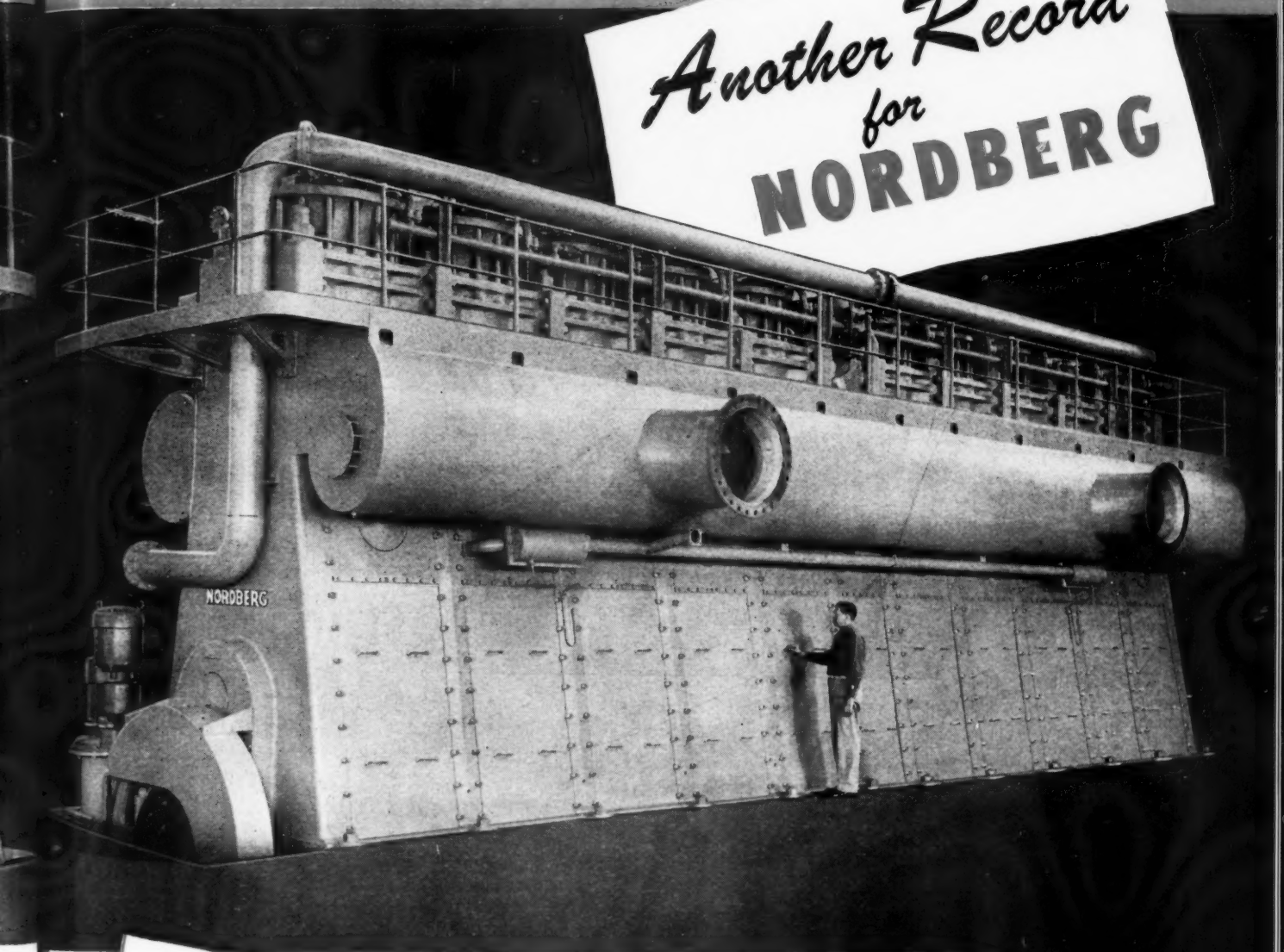


The position of leadership held by Nordberg in the large Diesel engine field is again evidenced by the building of this 7100 horsepower unit, the most powerful single acting Diesel generating set built in America. It is another achievement in the impressive record of more than thirty-five years of Diesel engine building. Whenever there has been a demand for units of greater capacity, Nordberg has met that demand. For greater dependability and higher efficiency, a Nordberg Diesel is available for your needs.

NORDBERG DIESEL ENGINES

DIESEL GENERATING UNIT BUILT IN AMERICA

Another Record for NORDBERG



Nordberg builds an extensive line of Diesel engines in sizes to 8500 horsepower, in two and four-cycle types for burning oil or gas fuels. Whatever your requirements, whether for stationary or marine service, it will pay to investigate the merits of Nordberg Diesel engines.

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN

ENGINE DATA

Horsepower (Net)	7100 (sea level)
Generator (Net)	5000 KW
Number of Cylinders	10
Bore	29 inches
Stroke	40 inches
Speed	164 R.P.M.

Two-Cycle, Mechanical Injection, Cross Head Construction, Motor Driven Scavenging Blower, Flywheel Type Generator.

For Stationary and Marine Service

One of a Kind

Powerful *Texrope* drive specially engineered for a large mill. This main driver sheave is 7 ft in diameter, has 30 grooves, transmits 1400 hp!

...or One of A THOUSAND!

EVERY TEXROPE DRIVE IS ENGINEERED FOR ITS JOB

YOU GET sound recommendations from Allis-Chalmers — recommendations backed by the greatest V-belt engineering talent and experience in the business.

Allis-Chalmers originated the Multiple V-belt drive 22 years ago. Since then, *Texrope* engineers have designed many thousands of drives, ranging from fractional horsepower units for manufacturers of small compressors, pumps or washing machines—to the largest V-belt drives ever installed. They've served: Textile, Mining, Metal working, Petroleum, Chemical . . . in fact, *every* major industry.

Take advantage of this vast research and experience. Bring your V-belt problems to headquarters — for the best in engineering talent — for the most complete line of V-belt equipment made.

Service is as close as your nearest Allis-Chalmers dealer or office. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 2239

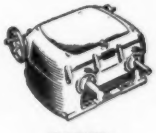
Refer to Sweet's Catalog

TEXROPE .. Greatest Name in V-Belt Drives

"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationary or motion control.



SPEED CHANGERS
Speed variations up to 375% at the turn of a crank.

ENGINEERING
Finest V-Belt engineering talent in the world—at your call.

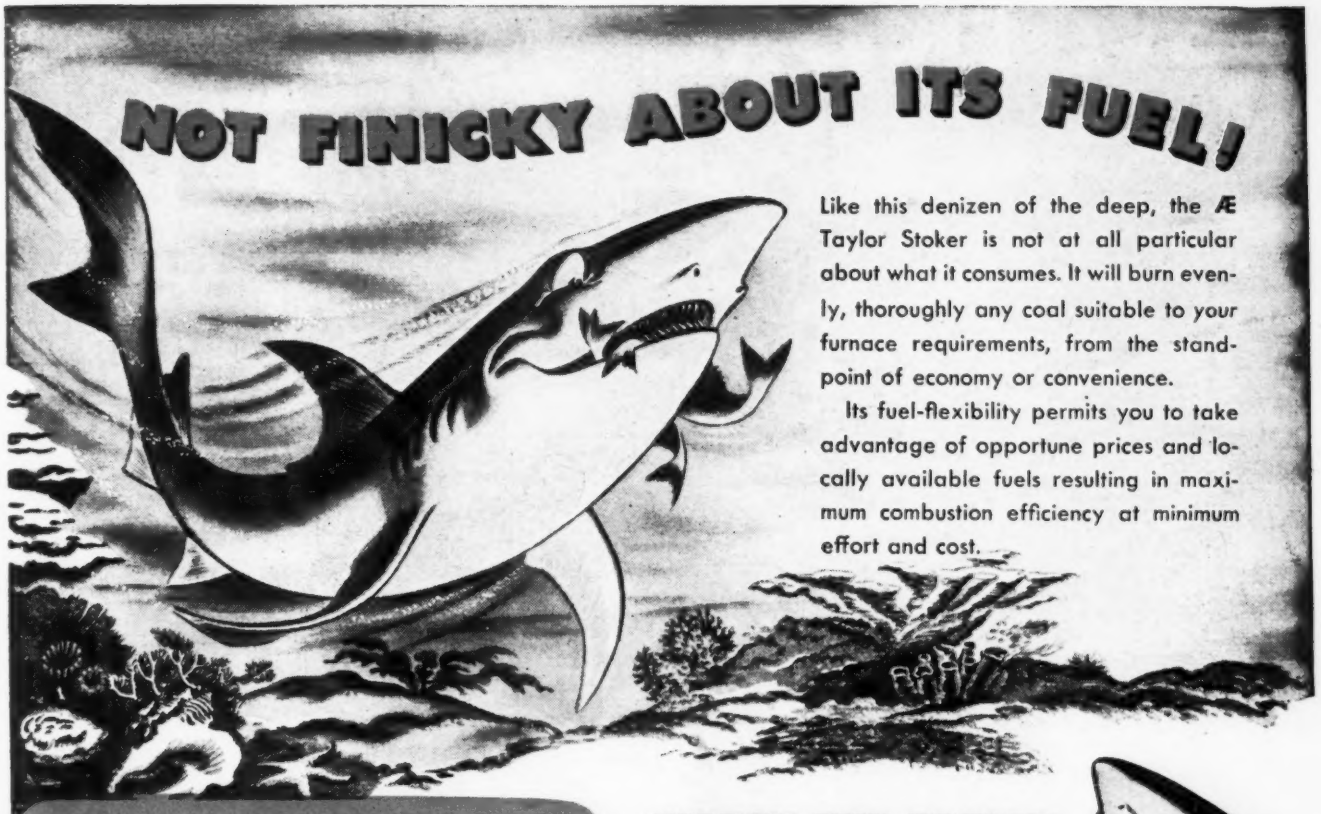
TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

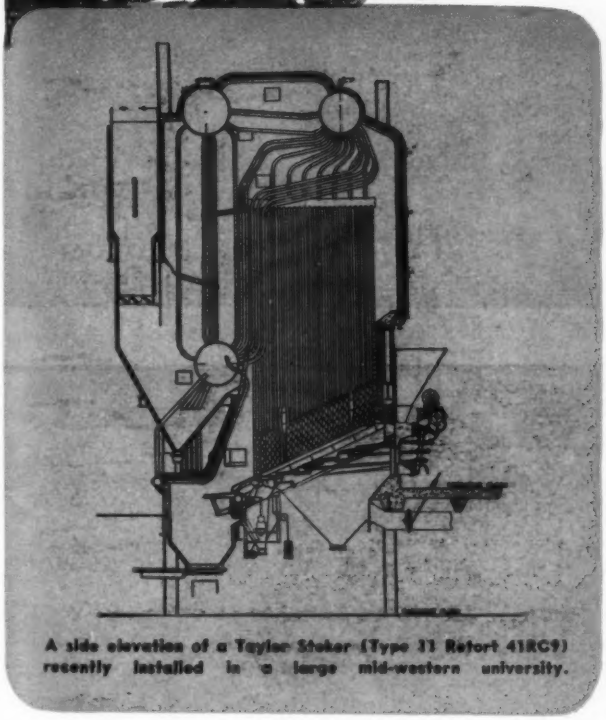
1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great

NOT FINICKY ABOUT ITS FUEL!



Like this denizen of the deep, the Æ Taylor Stoker is not at all particular about what it consumes. It will burn evenly, thoroughly any coal suitable to your furnace requirements, from the standpoint of economy or convenience.

Its fuel-flexibility permits you to take advantage of opportune prices and locally available fuels resulting in maximum combustion efficiency at minimum effort and cost.



A side elevation of a Taylor Stoker (Type 31 Retort 41RG9) recently installed in a large mid-western university.

WATCH THE TREND!

Buyers everywhere look to Taylor for stoker performance and economy. Executives, who know from experience, recommend Taylor for both original and repeat installations.

Better air flow and a precision control feed mechanism mean efficient, low-cost, steam generation and minimum stack discharge. With simplicity as the keynote, it is designed to give higher operating efficiency and lower boiler outage. These and many other exclusive advantages combine to give added efficiency to the time-tested Taylor Stoker.

Ask any one of the thousands of Æ Taylor Stoker users throughout the country and they'll tell you "the trend is toward Taylor"—*it's the leader!*

UP-TO-DATE FACTS ON THIS IMPROVED TAYLOR STOKER

If you aren't up to the minute on Stokers, get your copy of this booklet. Write to Department 24 today!

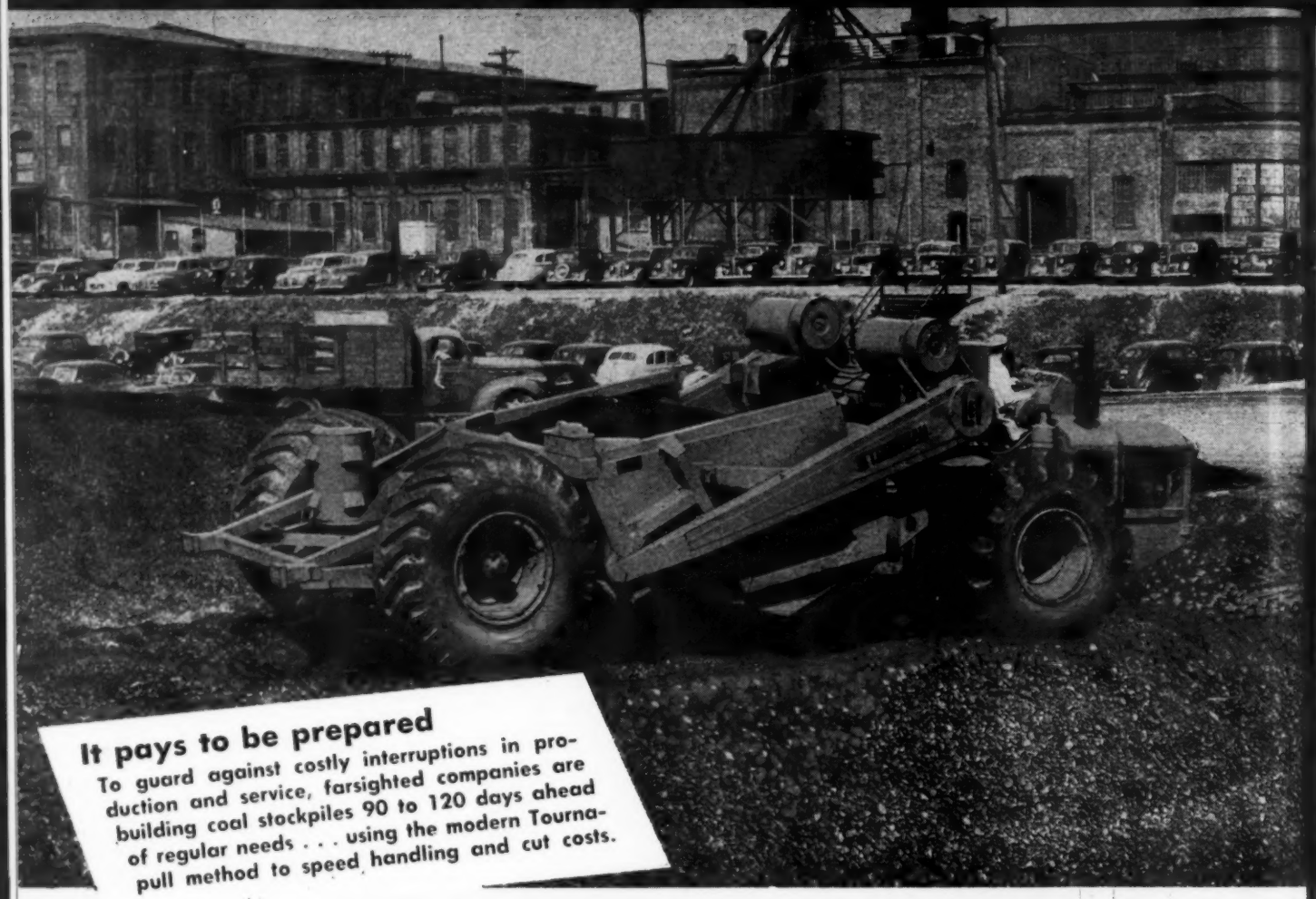
TAYLOR STOKER

Æ

AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.

Stockpile your coal

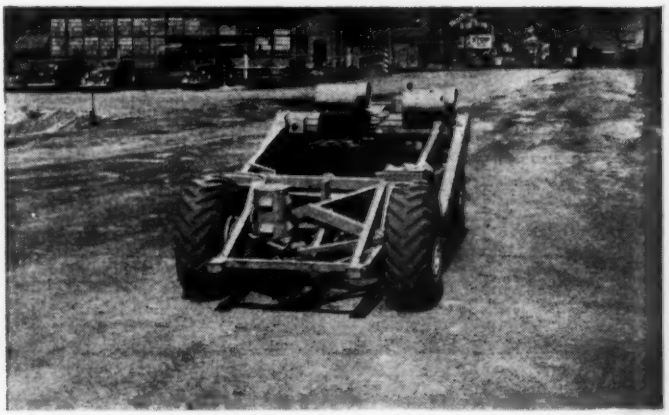


It pays to be prepared

To guard against costly interruptions in production and service, farsighted companies are building coal stockpiles 90 to 120 days ahead of regular needs . . . using the modern Tournapull method to speed handling and cut costs.

Picks up own load

Small size Tournapulls are self-loading . . . larger units require pusher assistance for maximum loads. Each unit is self-powered, individually operated by one man. Too, you can easily load Tournapulls direct from railroad cars by clamshell or overhead chute.



Hauls anywhere at high speed

Tournapulls travel over pavement or cross country at speeds up to 23 m.p.h. Tournapull method eliminates the requirement for overhead bridges and belt conveyors . . . does away with having to move heavy steel structures. Units are mobile . . . can put your coal stockpile anywhere.

LE TOURNEAU LET EQUIPMENT

See your Le Tourneau Distributor NOW for complete information

this faster, safer way

TOURNAPULL METHOD

speeds handling...saves storage space...

prevents combustion fires...

NOW, with the new high-speed Tournapull developed by LeTourneau Corporation, you can build up your coal stockpile in a hurry . . . pile more coal into smaller space . . . pack it down thoroughly to reduce internal combustion and provide better drainage.

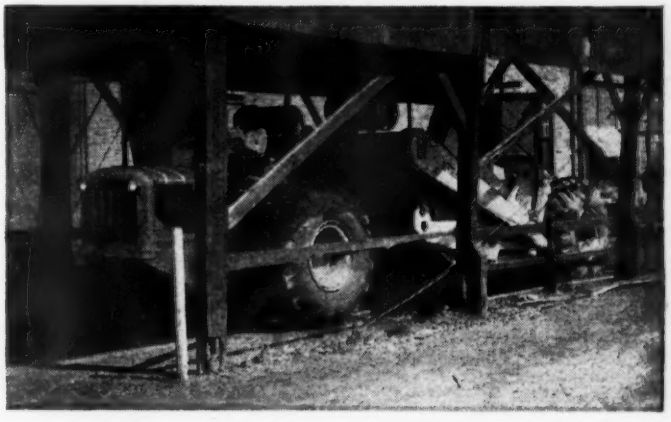
Using the Tournapull method, you can move from 2 to 16 tons of coal per trip, depending on Tournapull size . . . haul anywhere at average truck speeds . . . spread each load in smooth, uniform layers . . . compact coal without damage, through cushioning action of big, low-pressure tires.

Tournapulls also profitably handle ore, chemicals and other bulk materials to hoppers or conveyors.

For complete details on this modern, high-speed Tournapull method of handling materials get in touch with your nearest LeTourneau Distributor or write to: R. G. LeTOURNEAU, Inc., Peoria, Ill.

Compacts as it spreads

Tournapull spreads coal in 4" to 6" lifts. Big rubber tires and weight of unit give compaction while spreading or hauling . . . reduce danger of spontaneous combustion. Tournapull compaction also helps save storage space . . . minimizes infiltration of moisture.



Serves plant in emergency

During emergency stoppages, Tournapulls will load coal from stockpile . . . haul to plant . . . dump directly into bunker house grizzly or conveyors. Units also will haul over streets to service other company-owned plants in same city.

Tournapull is a registered trademark. Reg. U.S. Pat. Off. CM

LETOURNEAU
PEORIA, ILLINOIS

HIGH-SPEED RUBBER-TIRED

TOURNAPULLS

"The Battery For Today!"
One of many plants using Worthington multiple compressor installations in the processing of gases

THAT KEEPS AIR-COSTS FROM PILING UP A SCORE

The more compressed air or gas you use, the more you can economize with Worthington Opposed Steam Driven Compressors With over 50 years of development behind them, these rugged, tireless performers are up-to-the-minute in every last cost-saving detail. For example:

Pressure feed lubricates each side independently, reducing outage and maintenance to a minimum . . . full accessibility to all steam and air cylinder interiors by removal of rear cylinder heads only . . . modern, trouble-free bearings for uninterrupted service . . . and Worthington Feather* Valves, most efficient ever made.

Reduced Labor and Maintenance Costs

Following the Worthington formula, these modern Compressors combine high performance efficiency with minimum maintenance requirements. Their ability to do a better job, year after year, on amazingly low operating costs is familiar proof that *there's more worth in Worthington.*

Write for Bulletin L-680-B1A. *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.* K7.7

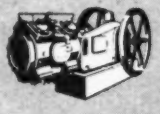
WORTHINGTON

*Reg. U. S. Pat. Off.

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

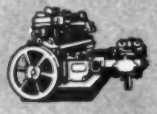
Y-types

Vertical

Horizontal 

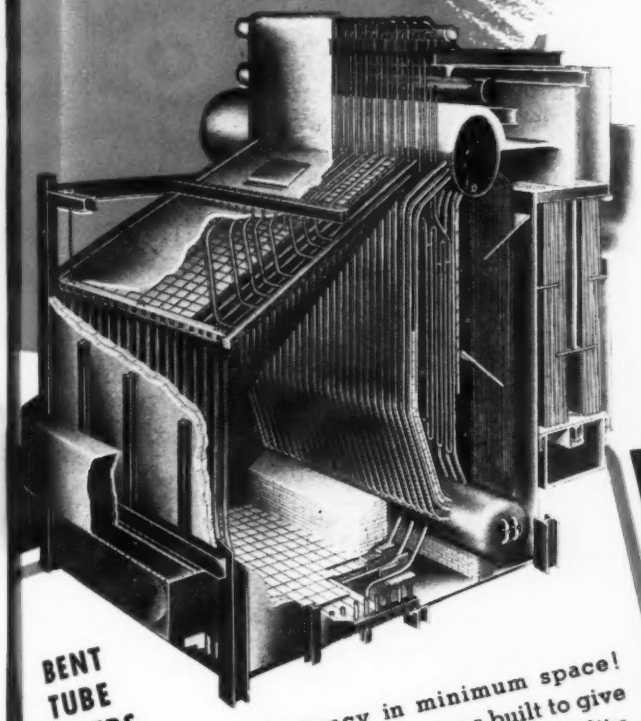
Portable

Radial

Gas-Engine Compressors 

SPRINGFIELD

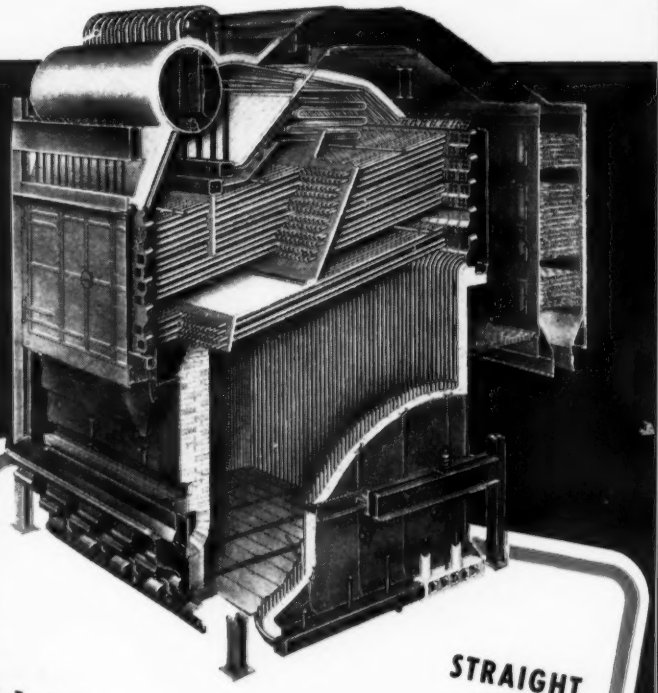
Boilers to meet your needs



SPRINGFIELD is building boilers for virtually every branch of industry: boilers for PAPER MILLS . . . high pressure boilers for UTILITIES . . . boilers for MEAT PACKING PLANTS . . . special boilers for CHEMICAL MANUFACTURERS . . . low pressure boilers for HEATING service . . . boilers for OVERSEAS. Springfield service includes design, fabrication, and erection of complete steam generating units with firing, draft, and control equipment—all taken on a "Single Responsibility" contract. *For boilers "to meet your needs," see Springfield!*

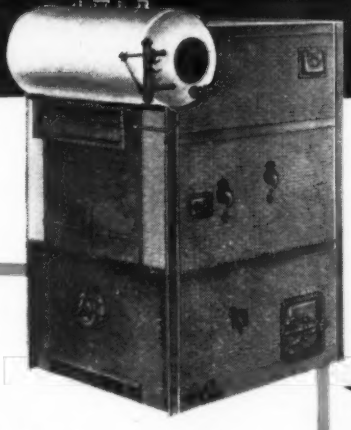
BENT TUBE BOILERS

● For maximum efficiency in minimum space! Carefully balanced Springfield designs built to give extra values in performance and dependability. Water cooled furnace. Gas flow distributed uniformly across width of unit. Dry steam. Minimum superheat variation over wide load range. Built in any capacity from 20,000 lbs. up.



STRAIGHT TUBE BOILERS

● A design preferred by many engineers. Big overload capacity; quick response to loads. High availability; less outage. Every quality feature you want in a boiler. Specially designed for capacities to 450,000 lbs. per hour and higher. Springfield patented center water wall construction available for large units.



TYPE M STANDARDIZED BOILERS

● Standardized for quicker delivery . . . lower cost. 7 sizes to choose from, ranging from 6,000 to 17,000 lbs. per hour. Built like a "BIG PLANT" boiler—*for the smaller plants!* Water-cooled furnace—all of Springfield's finest quality features.

ASK FOR LATEST INFORMATION

SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Ill.

Please send latest information on Springfield's:

☐ Bent tube boilers ☐ Straight tube boilers ☐ Type M boilers
☐ Center water wall furnaces ☐ Have representative call

*Name*_____

*Company*_____

*Address*_____

THE C-E PACKAGE Gives Top Performance at Minimum Cost Here's why...

The C-E Package Boiler was *designed for* [illegible] *service* – industrial loads, particularly [illegible] plants having small operating and maintenance forces. Consequently, every element is combined in *balanced relationship* to produce definitely planned operating advantages – efficiency over a wide range of output, ability to take rapid load swings, the production of steam of satisfactory quality at all ratings, together with simplicity of operation and minimum maintenance.

No assembled compromise could insure such results. Required is the complete coordination of all components – *balanced design* – by a single manufacturer who controls every element of design and construction. C-E does this, and with *one* contract, *one* guarantee and *one* responsibility, provides the top performance you have a right to expect from years of leadership in steam generating equipment.

Moreover, you gain the benefit in the purchase price of the savings made possible by standardized design. And in efficiency, simplicity of operation and low maintenance, you have added savings that lower costs substantially.

It is not surprising that plants in widely different industries have selected the boiler of balanced design for top performance at minimum cost.

If you are in need of new steam generating equipment it will pay you to investigate the advantages of the C-E Package Boiler. B-157

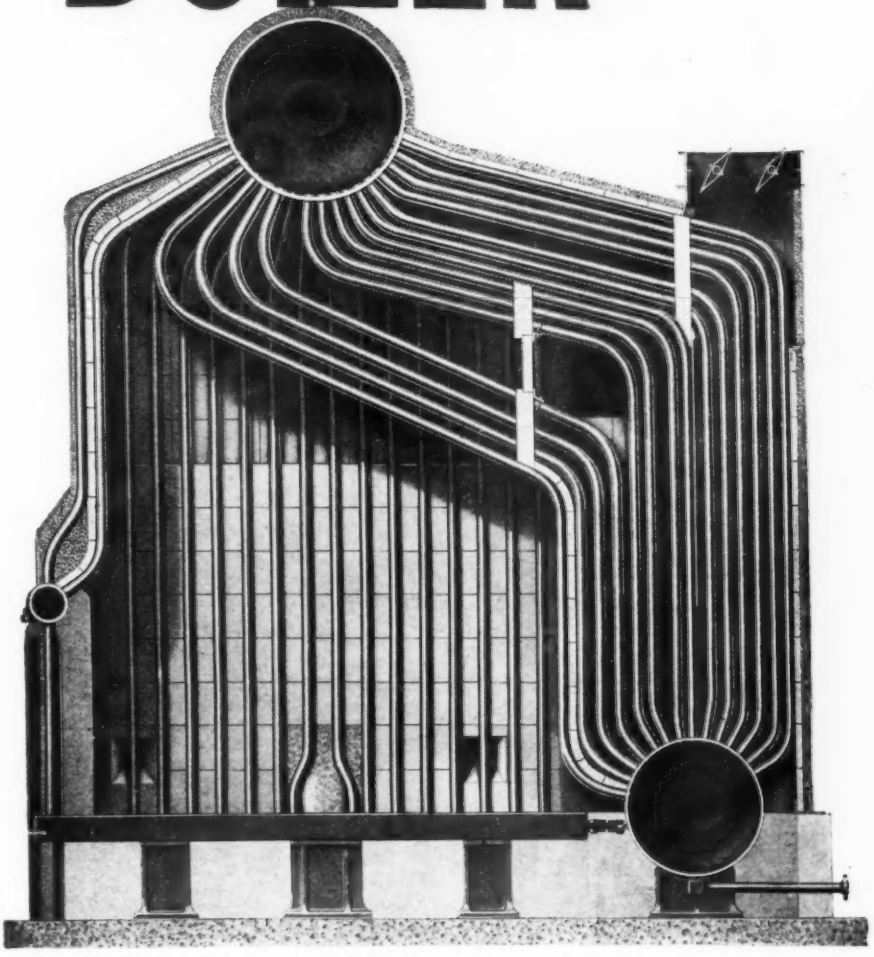
A partial list of industries that have selected the C-E Package Boiler during the past year.

Bakery	Leather	Paper
Chemical	Linoleum	Railroads
Dairy	Machinery	Rubber
Glass	Metals	Textile
Hospital	Packing	Tobacco
Hosiery	Paints	Utility

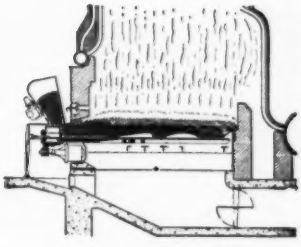
COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; ALSO MANY TYPES OF PRESSURE VESSELS

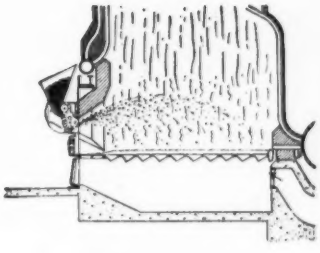
BOILER



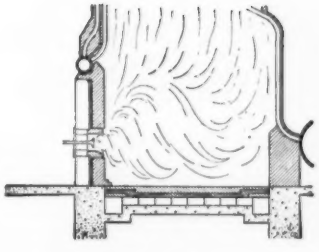
Furnished in capacities of 15,000 to 40,000 lb of steam per hr, or more, the Package Boiler is designed for four methods of firing — spreader stoker, single-retort underfeed stoker, oil or gas burners. Any of these methods may be substituted for any other should a change in the fuel market occur.



Type E Underfeed Stoker



Spreader Stoker



Oil or Gas Burner

MAINTENANCE ADVANTAGES

1. Any tube in the furnace or boiler convection bank can be removed and replaced without disturbing any other tube.

2. Amply sized tubes reduce tendency for solids to deposit and are easier to clean. All tubes can be de-scaled from top drum.

3. Integral soot blowers enable the operator to keep tube surfaces clean.

4. Front and side walls of the furnace are fully water-cooled, virtually eliminating refractory maintenance.

ENGINEERING

200 MADISON AVENUE • NEW YORK 16, N. Y.

Should your AIR-POWER *system be* CENTRALIZED *or* DECENTRALIZED?

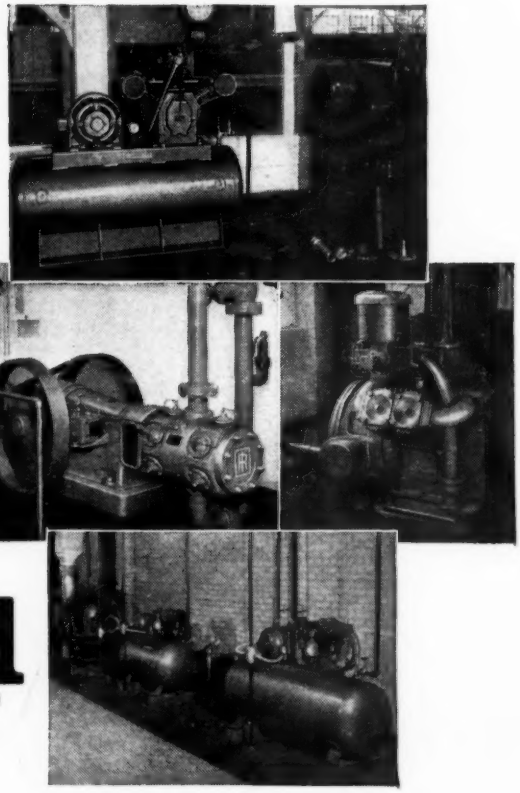
If you have a shop where you need Air Power at scattered or isolated spots, your first impulse may be to install a decentralized source of Air Power . . . a small compressor at each location. But before doing this, consider these points:

Flexibility — **Load Factor**
Power Rate — **Piping System**
First Cost — **Attendance**
Installation — **Maintenance**

For example, during certain hours, seasons, or cycles, the maximum demand for air may shift from one part of your plant to another. If you had a central compressor plant with an adequate piping system, the full capacity of your entire plant could be made available to *any* section of the shop at *any* time. You may find that part of shop should have a centralized system, the other decentralized, or a combination of both systems.

• • •

When you plan a new plant or an extension, or feel that it's time to modernize your system, call in an Ingersoll-Rand engineer. He's an Air-Power Specialist, and represents a company that builds a complete line of compressors...for centralized, decentralized, or combination systems... sizes from ½ to 3000 horsepower . . . air-cooled and water-cooled types . . . pressures from vacuums to 15,000 psi. . . . drives by electric motor or built-in steam, gas, or diesel engines.

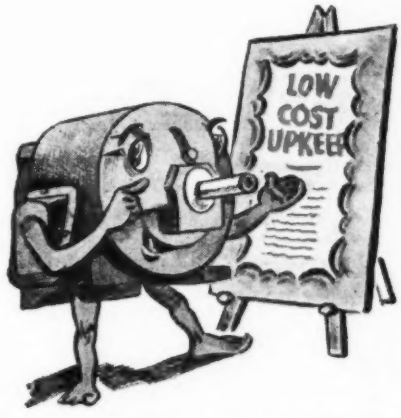


COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

Ingersoll-Rand 5-1

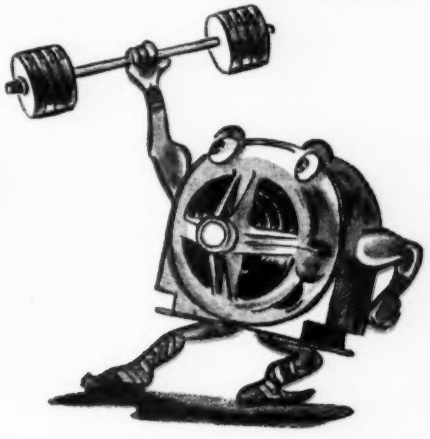
11 BROADWAY, NEW YORK 4, N. Y.

"Puzzled over which type of motor to buy?"



In 80% of the Cases, open squirrel-cage induction motors meet the need. They fit most drives, and can be obtained in numerous standard and special designs to meet varying conditions of starting torque, slip, etc. They are also the most economical type to buy and to maintain. Allis-Chalmers builds induction motors in sizes from ½ to 10,000 hp — or higher, if needed.

For Tough Starting Conditions, wound-rotor induction motors are recommended. Their high starting torque, at comparatively low starting current, and their controllable speed characteristics are desirable in drives for conveyors, grinding mills and other tough starting assignments. Compact, accessible Allis-Chalmers wound rotor induction motors range in size from 5 to 10,000 hp.



For Slow Speed, direct-connected drives as low as 75 rpm, or other constant speed applications at higher rpm, synchronous motors are a good solution. They are of particular benefit when a system's power factor is low, since they can be furnished for operation at either unity or leading power factor. From 40 hp to 50,000 hp and higher — in bracket bearing, pedestal bearing, or engine types.

Is d-c Available? Then adjustable speed operation is easily obtainable. Allis-Chalmers builds d-c motors from ½ to 10,000 hp and higher — for constant or adjustable speed duty in ranges of 6:1 and lower. By means of a source of d-c voltage, adjustable speed motors may also be designed to operate over a speed range as high as 30:1. Suitable for fans, elevators, etc.

Select from the Complete Allis-Chalmers Line!

NOT JUST FOLLOWING popular choice and using a standard squirrel cage induction motor. But the *right* motor for economy and efficiency.

That means an overall knowledge of *all* types of motors . . . their operation . . . limitations . . . maintenance. And there's where your A-C representative can be a big help. His recommendations are backed by experience . . . and the Allis-Chalmers motor he selects is *itself* backed by 50 years of experience in motor design and building. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2304

1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment-
Biggest of All in Range of Industrial Products

IN DAYTON *it's* ELECTRUNITE

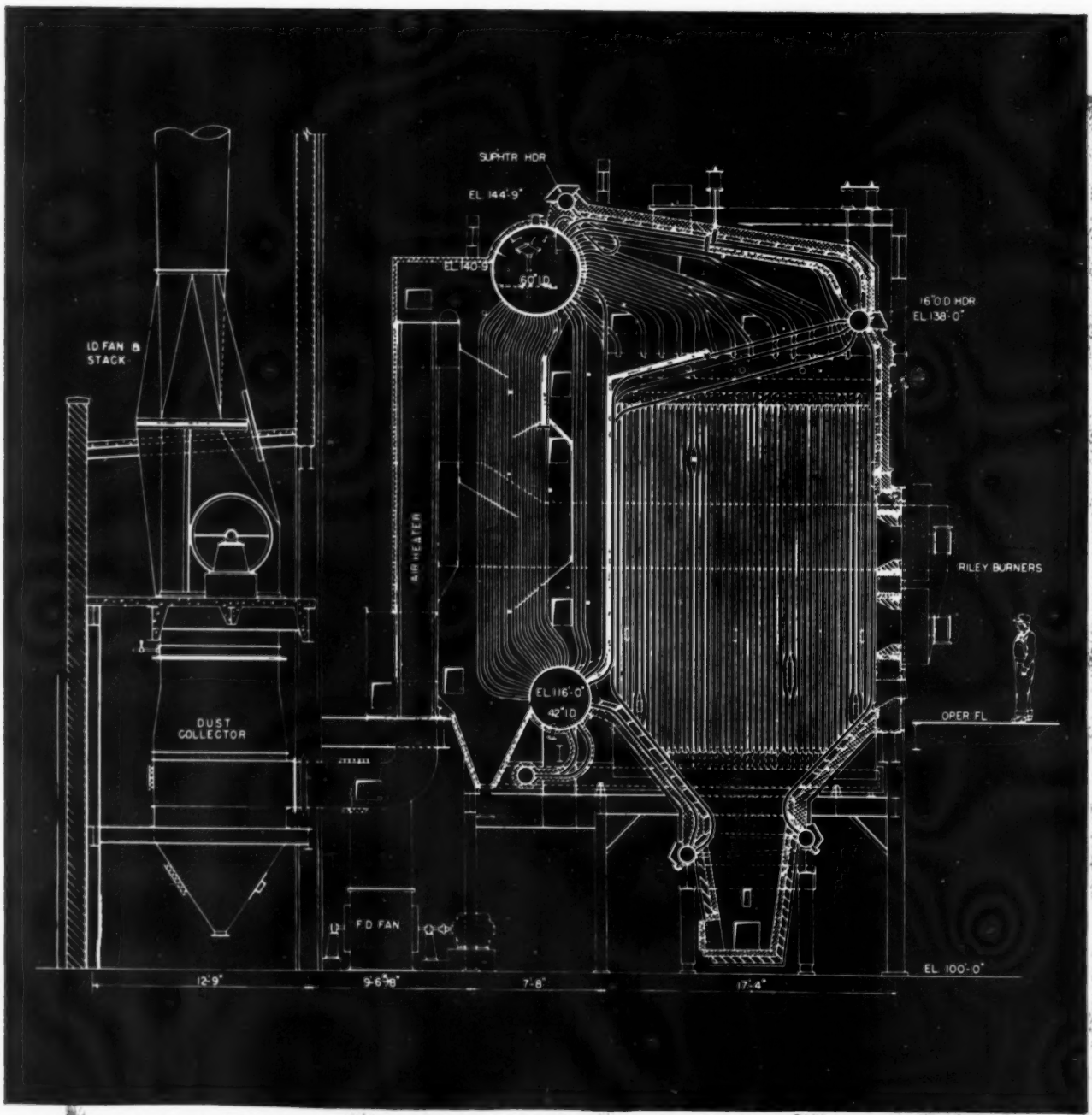


Diagram courtesy Riley Stoker Corporation.

INSTALLED AS ORIGINAL EQUIPMENT IN NEWEST STEAM GENERATING UNIT AT THE DAYTON RUBBER COMPANY

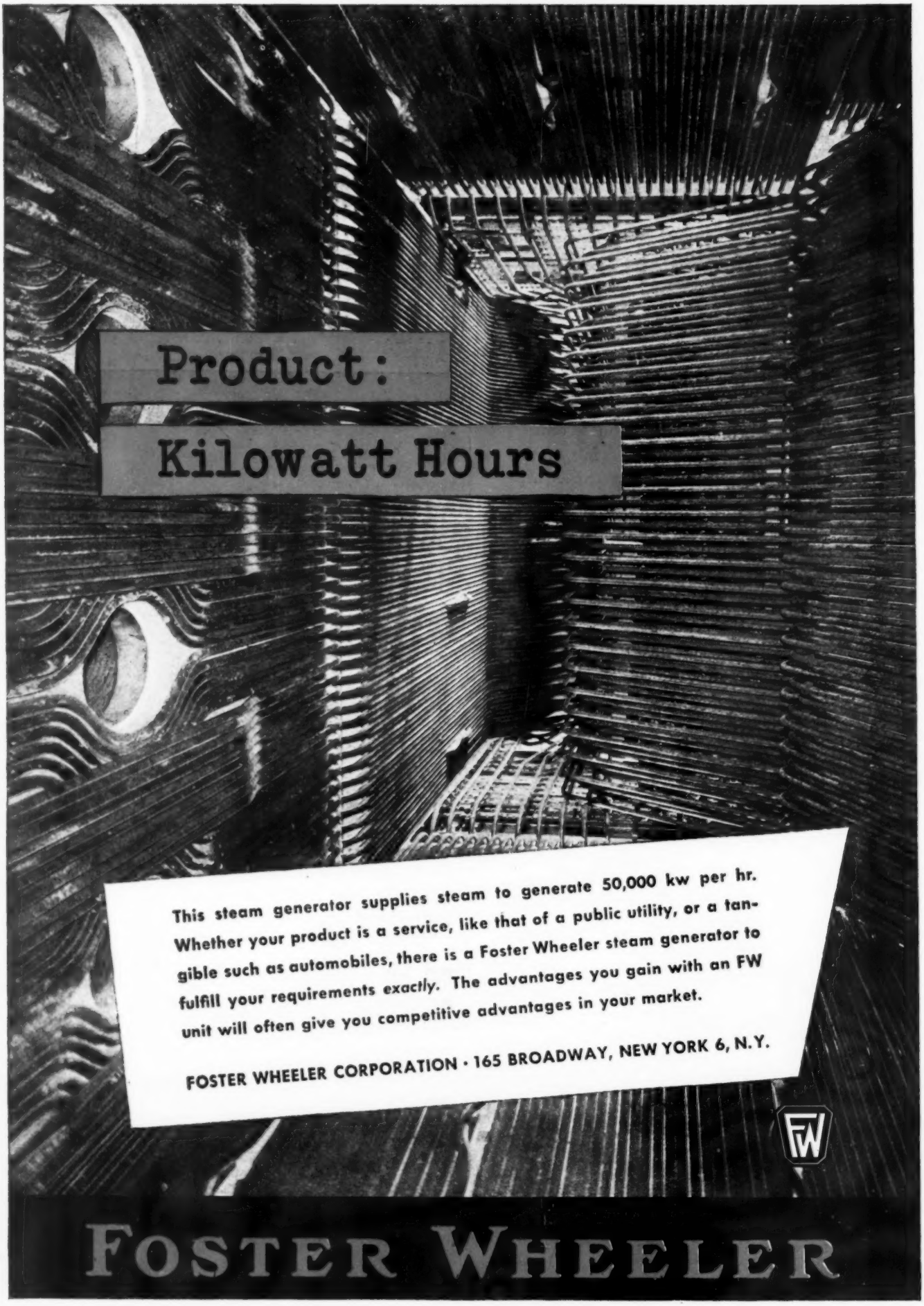
● Fifteen minutes without adequate steam at proper pressure and manufacturing operations at The Dayton Rubber Company would come to a halt. That's why engineers and officials of this modern plant are particular about the equipment in their boiler plant . . . particular, too about the tubes which are used in that equipment.

Since January 20, 1946, when Dayton Rubber's new boiler plant was put into operation, Republic ELECTRUNITE Boiler Tubes have seen active service in the large steam generating unit, shown in the diagram, which produces more than 2,000,000 pounds of steam daily. Mr. B. J. Ricking, Power Engineer, states, "We are completely satisfied in every respect with the performance of ELECTRUNITE Boiler Tubes".

Whether you are concerned with retubing of present equipment, or specifying tubes for new units, it will pay you to investigate the dependability and many cost-cutting advantages of these *modern* boiler tubes made by Republic's *improved* process of electric resistance welding. For informative literature or technical data pertaining to a specific problem, write *today* to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

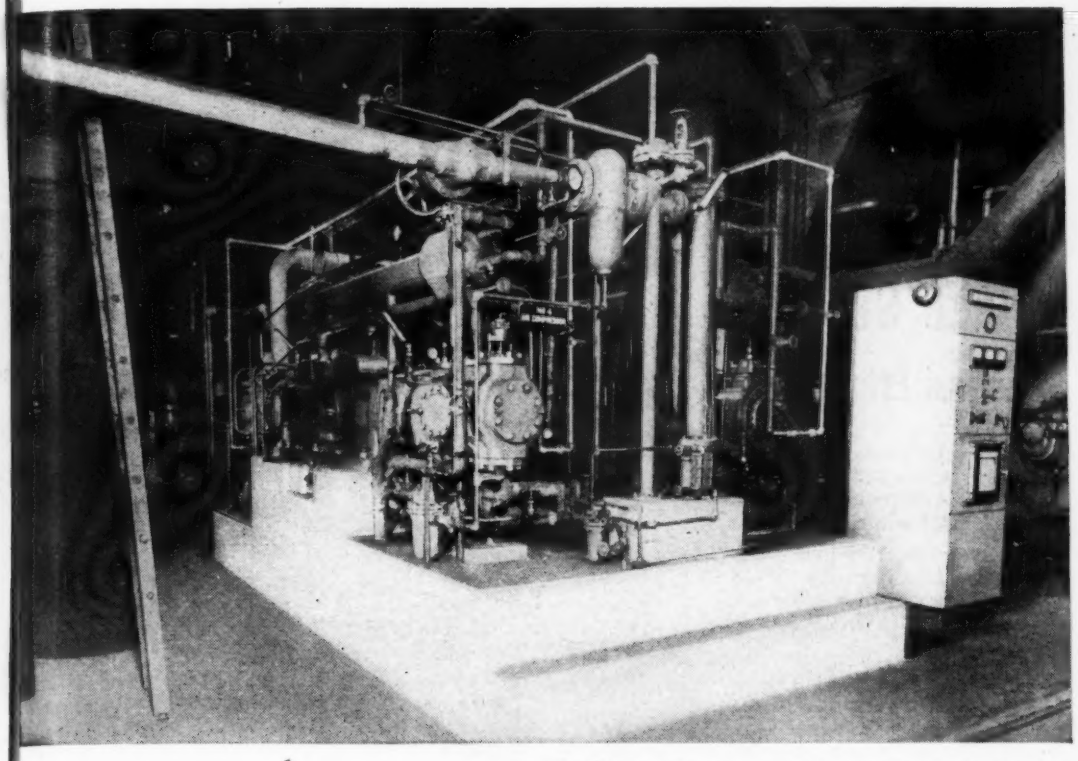
Republic
REPUBLIC STEEL
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES


Product:
Kilowatt Hours
This steam generator supplies steam to generate 50,000 kw per hr. Whether your product is a service, like that of a public utility, or a tangible such as automobiles, there is a Foster Wheeler steam generator to fulfill your requirements exactly. The advantages you gain with an FW unit will often give you competitive advantages in your market.
FOSTER WHEELER CORPORATION · 165 BROADWAY, NEW YORK 6, N.Y.
FW
FOSTER WHEELER

NEWS

FROM THE POWER FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON



Worthington Compressor at Kearny Generating Station.

Air Cleans Boilers Better Than Steam

General practice in cleaning boiler walls and tubes is to blow saturated steam into the boiler under high pressure. This method is preferred in many plants despite the fact that modern steam boilers are delicately balanced and any considerable use of steam for this purpose necessitates bringing in new water that has to be treated, heated, etc.

At the Kearny Generating Station of Public Service of New Jersey, a further objection was a tendency for "quench cracks" to form in the high-temperature-resistant alloy tubes, particularly around the cleaner port.

Soot cleaning at Kearny (as elsewhere) became more of a problem during the war, when the ash content of the soft coal burned in the boilers increased substantially. Even now, ash runs about 10 to 12%.

To simplify cleaning, Public Service decided to abandon steam in favor of compressed air, and the Mercury boiler at the Kearny Station was equipped with a compressed air system installed by Worthington.

Air at Two Pressures

The 1000 cfm compressor delivers air at 500 lb pressure. The air passes through oil removers, then goes to a 1000 cu-ft storage receiver located on the outside of the building. From this large receiver air passes through a reducing valve and enters the 100 cu-ft tank where 250 lb pressure is maintained. Operating with air at two different pressures permits the use of a smaller compressor, since the air may be stored at the higher pressure between blowing operations and expanded to the lower working pressure as needed.

Because of the size of the boiler and the fact that a considerable number of soot blowers are needed to keep the surface clean and provide for good heat transfer, provisions have been made to do the cleaning automatically, and a regular cycle has been developed. The cleaning goes on continuously while the boiler is in operation.

It is intended to have all new boilers now under construction at the Essex and Sewaren Stations blown by air. Performance of the Worthington compressor has been completely satisfactory, particularly in respect to the small amount of maintenance.

Year 'Round Air Conditioning at WSPA Radio Station

A 24-ton year-'round air conditioning unit which cools and dehumidifies in the summer, heats and humidifies in the winter, has been installed in radio station WSPA, Spartansburg, S. C., by Montgomery & Crawford, Inc., Worthington distributor.

The air unit is a Worthington DH-440 with cooling and heating coils. Two Worthington 3HF4-10S condensing units (10 hp.) are connected in parallel with oil and gas equalizer lines. Both of these machines are mounted on a concrete base. The installation uses a 28C4 evaporative condenser mounted on the outside rear of the studio building.

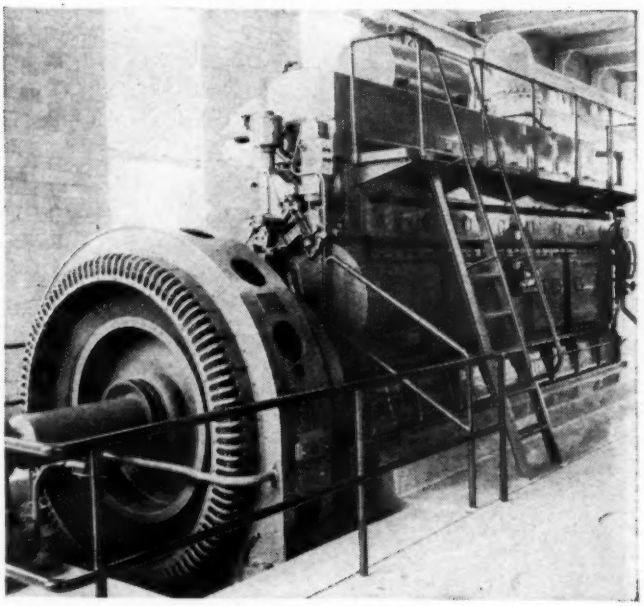
Supercharged Dual-Fuel Diesel Goes Into Service

. . . Over 36% Thermal Efficiency

What can be accomplished by supercharging a dual-fuel Diesel engine has been demonstrated by the performance of the new Worthington engine in the municipal power plant at Lamar, Colorado.

This 1530 hp engine, recently installed to drive a 1080 kw generator, has turned in a record of over 36% thermal efficiency—7050 net btu per brake horsepower hour (total of gas and pilot oil fuels) at full load. Elevation is 3600 ft.

The Worthington engine at Lamar uses natural gas on the Diesel cycle, but in case of gas line failure, it is quickly convertible (by a turn of a wheel) to Diesel oil or any mixture of gas and oil. With gas, the fuel cost is slightly more than one mill per kw.



SEHGO-8 supercharged Worthington Dual-Fuel Diesel engine.

Horsepower Increased 50%

The supercharger utilizes the energy of the engine exhaust to drive a blower which supercharges the engine. In addition to increasing horsepower about 50%, this improves mechanical efficiency and scavenging, resulting in lower fuel consumption. Lubricating oil requirements are also reduced. Further economies result from the lower installation cost: less building space, smaller foundations, etc.

The new generating unit is being used for peak loads and standby services.

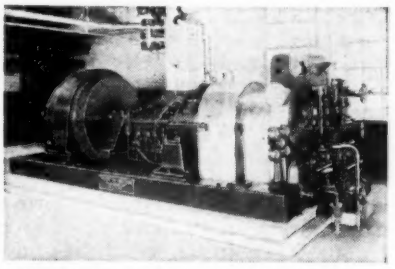
Pump room at The Electric Hose & Rubber Co.

Pumping Lower Costs Into Electric Hose

Installation of new pumping, as part of a one million dollar program of modernization, is credited with helping The Electric Hose & Rubber Co. of Wilmington, Delaware, to increase output to 140 million feet a year (nearly 50% above the wartime level) and to reduce prices 18-30%.

The pumping equipment consists of four Worthington horizontal duplex Type KUF power pumps with 1¾ in. bore x 12 in. stroke. Each is direct-driven by a 200 hp 3-phase, 60-cycle, 2300 volt, 600 rpm motor. Each pump furnishes liquid under 5000 psi to individual 2100 ton 33"/11½" Watson Stillman lead extrusion presses. An independent piping layout for each pump and press constitutes the pumping system. About 10 ft suction head is maintained. Each pump is rated at 40 gpm, 6000 psi, at 84 rpm.

Supplementing the hydraulic power for the major extrusion process is a Worthington vertical triplex size 2 x 4 VTE power pump rated at 50 gpm, 950 psi at 350 rpm, driven through Worthington Multi-V-Drive by a 30 hp, 1160 rpm motor. This pump is tied into a weighted type accumulator which furnishes liquid under pressure to the lead billet hydraulic lift on each 2100 ton press.



Worthington 500 KW turbine at New York's Incinerator Plant on 56th St.

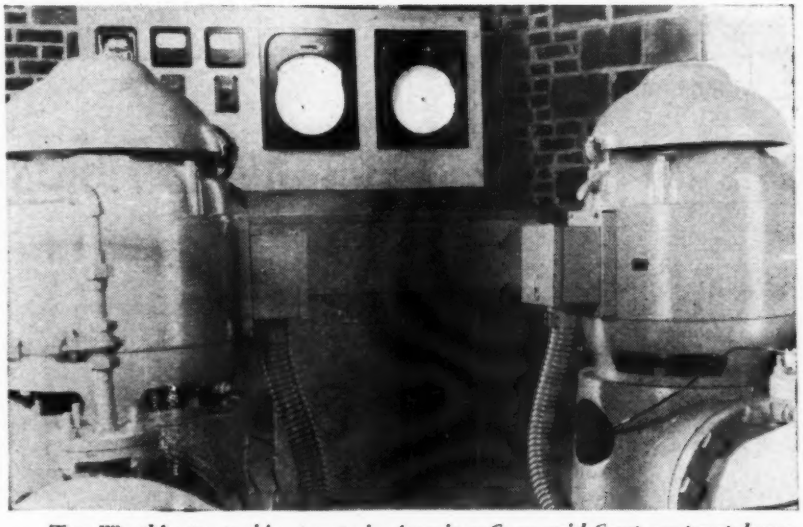
The Incinerator on 56th Street

New York City maintains an incinerator plant on 56th Street. This plant uses the heat generated in burning refuse to make power for operating the cranes, lights and plant auxiliaries.

Two Worthington 500 KW alternating current geared turbine-generator units supply the power. Installed in 1936, they operate on steam at 200 lbs pressure supplied from the waste heat boiler and exhaust at 5 lb back pressure.

Worthington Pump and Machinery Corporation
Harrison, N. J.

NEWS



Two Worthington turbine pumps in American Cyanamid Company pump house.

Worthington Helps Ranney System at American Cyanamid Company

American Cyanamid Company's new plant in Wallingford, Conn., is located on sandy flats adjacent to the new (as yet unfinished) Merritt Parkway out of New York City.

One of the principal problems was to find a suitable source of process water. The plant being located in a valley, it was presumed that enough ground water would be available. But after six wells had been placed in operation, it was found that the geological formation was such that the water supply dwindled, leaving no reserve for plant expansion.

A survey of subterranean water sources was made by an experienced geologist who disclosed that a valuable aquifer existed on the property. One of the latest types of water collecting system, designed by the Ranney Water Collector Corporation of New York, was installed.

The system works this way. 1, A large area of water-bearing formation is exposed to horizontal screen pipes located below the ground water table. 2, Selective removal of the fine material from the aquifer in the vicinity of the screens and the formation of more permeable ground or a gravel pack adjacent to the screens produce a series of radiating drainage canals emptying into a central shaft. 3, The lines lead to portholes in the lower section of a concrete cylinder, sealed at the bottom. (In this case, the caisson is about 90 feet deep.)

This compact unit is capable of producing, for American Cyanamid Company, 5 million gallons per day. The water is colorless, odorless, tasteless and bacteria-free due to the large infiltration area and the 80-ft depth of sand and gravel through which it travels to reach the collector pipes.

Worthington In the Pumping Station

This system is capable of producing 5 million gallons per day—far more than needed at present.

Two Worthington turbine pumps were selected for the pumping station. Each has a capacity of 1000 gpm. The flexibility provided by the Worthington design is ideal because added capacity can be obtained from each pump at moderate additional cost.

Water from bottom of caisson is pumped to a supply tank located above ground, from which it feeds two Worthington centrifugal Monobloc pressure pumps supplying the plant pressure system.

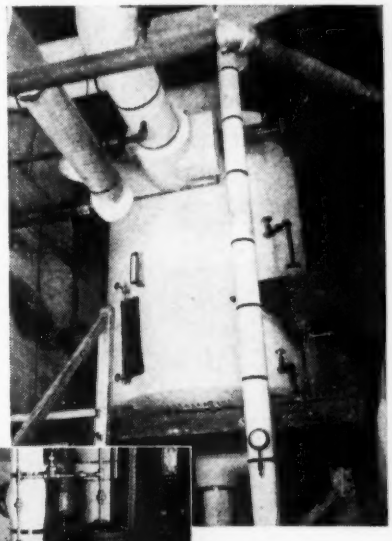
Deaerating Feedwater Heater Earns $60.00 Per Day

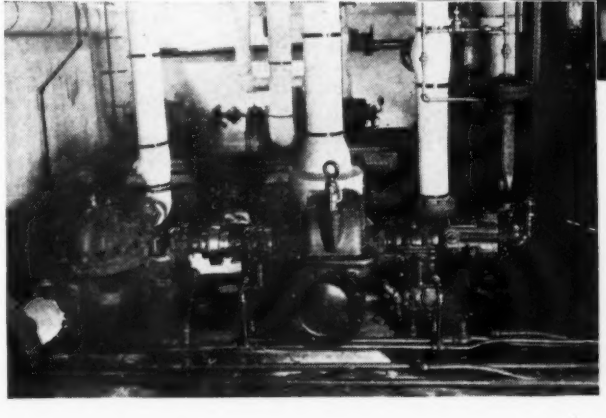
Using undeaerated feedwater at 140 degrees gave Providence Dyeing Bleaching and Calendering Company a lot of trouble with leaking boiler tubes. Then a new Worthington 80,000 lb per hr Deaerating Feedwater Heater was installed; delivering deaerated water at 240 degrees, it stopped the trouble and provided a bonus of $60.00 a day in the form of reduced fuel cost.

Operating figures for the job are: 100,000 lb per hr maximum, 15 ft NPSH, 3550 rpm, 160 lb pump discharge, 150 lb steam at turbine throttle, 10 lb steam turbine back pressure.

The hot water returns are pumped from a surge tank to the heater by means of a Worthington turbine driven Monobloc pump with a motor driven Monobloc pump as standby.

The flow of returns to the heater is controlled by a float-operated regulating valve on the heater. There is also a regulating valve on the heater for controlling flow of emergency cold water make-up when and if needed by the heater.





(Photo above)—Worthington Deaerating Heater at Providence Dyeing Bleaching and Calendering Co. 0.03 cc. oxygen per litre deaeration, 2 minutes water storage.

(Photo at left)—Worthington 2-UB-2 Centrifugal Boiler Feed Pump driven by Worthington-Moore R2R Steam Turbine (Standby in background).

7-7

Scovill Tube News

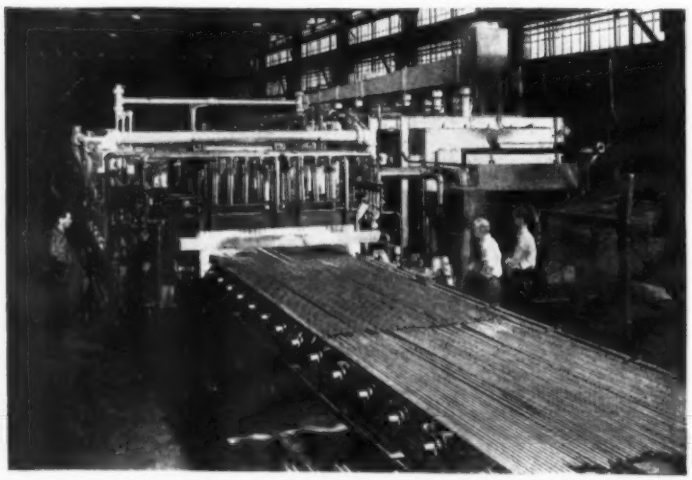
Vol. 5 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 3

Why Scovill Condenser and Heat Exchanger Tubes Consistently Meet Customer Specifications

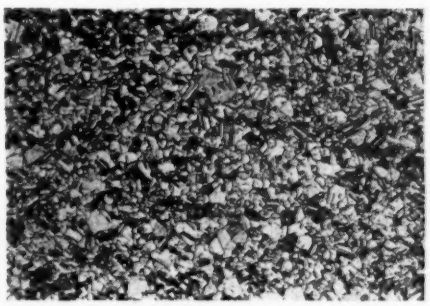
Longer tube life in marine, oil, surface condenser and other heat exchanger applications is assured when mill procedures are technically standardized to produce tubes that consistently are in accordance with customer specification requirements.

For example, the average grain size requirements of 0.010 to 0.045mm for condenser and heat exchanger tubes are met by annealing a single layer of tubes in a roller hearth, gas fired, automatically controlled furnace. The rate of travel of the tubes through the furnace and the temperature have been standardized for each alloy and size. Routine check grain size determinations verify the consistency of the anneal.

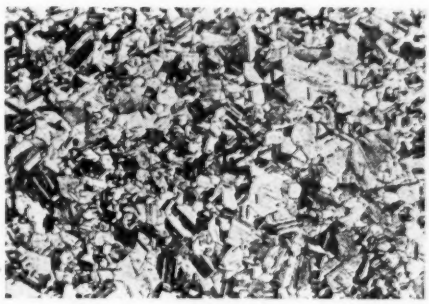
Just as important as the temper of annealed tubes are the dimensional requirements. Diameter, wall thickness, eccentricity, length and general appearance of



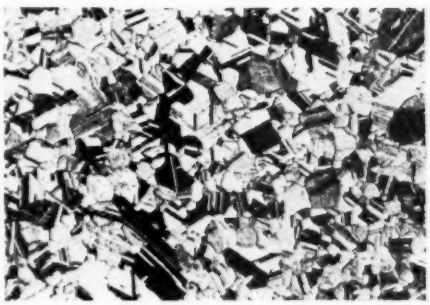
Single layer of Tubes emerging from Roller Hearth Annealing Furnace



0.020mm



0.030mm



0.040mm

Grain Size Check

all tubes are carefully inspected to check uniformity of the product. Standard procedures result in product consistency and uniformity.

Every finished tube is subjected to a 1,000 pound hydrostatic pressure and an 80 pound pneumatic pressure test to insure soundness of tube walls. This test procedure is rigidly followed as a matter of insurance, even though tube rejections at this inspection are very infrequent.

Inspection of Tubes

Hydrostatic Testing of Tubes

Three Scovill Services

Service in Manuals, of which "Scovill Tube News" is a sample, consists of literature providing the latest, most authentic information* on condenser and heat exchanger tubes, which has its source in the broad experience of our engineers and the findings of our laboratories. *Service in Men* offers specialized consultation on individual tube application problems and suggestions regarding alloy selection and tube installation practice. *Service in Metals* includes the development and production of a wide range of tube alloys under laboratory control, which verifies that Scovill alloys conform to specifications.

*A "Condenser Tube Booklet" is available. Scovill Manufacturing Co., 13 Mill Street, Waterbury 91, Conn. *Export Dept.*, 405 Lexington Ave., New York 17, N. Y.

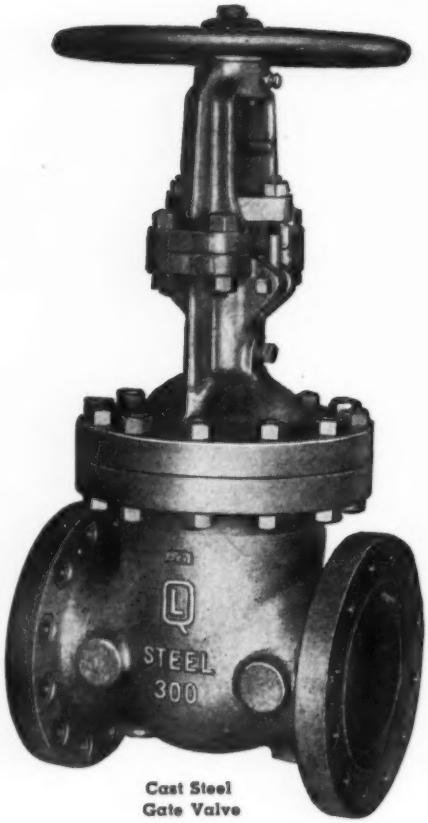
SCOVILL

HEAT EXCHANGER TUBES

ONE PRODUCT... THREE SERVICES

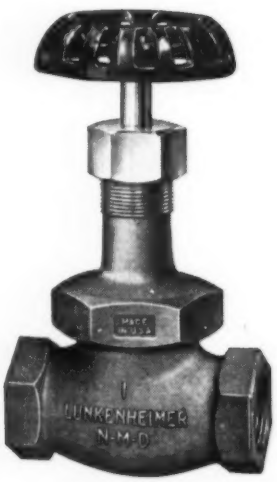
Service in Manuals... Service in Metals... Service in Men

This is Number Twenty-two in a series of Scovill advertisements to help you get longer life from condenser and heat exchanger tubes.

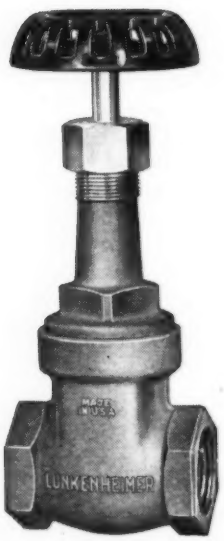


Cast Steel
Gate Valve

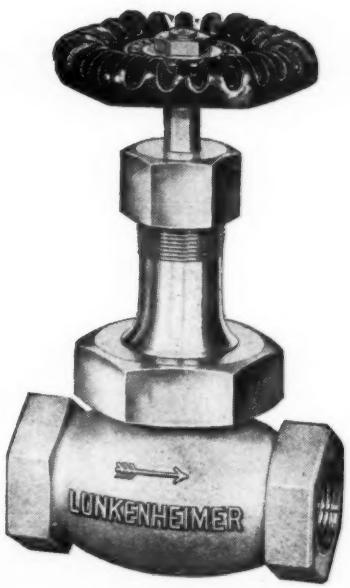
Iron Body
Gate Valve



"N-M-D"
Globe Valve



Bronze
Double Disc
Gate Valve



Bronze Plug Type
"Renewo"

LUNKENHEIMER VALVES

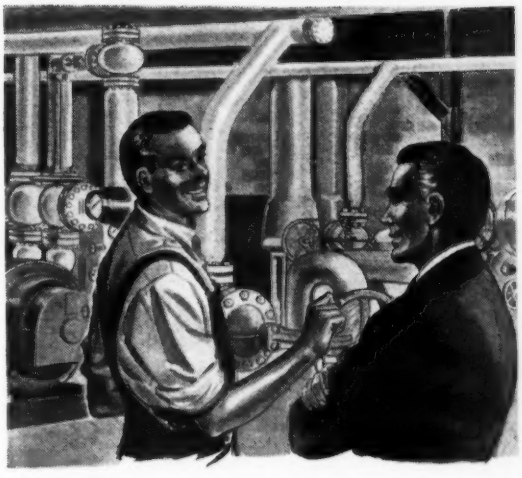
TIGHT VALVES *Save Fuel!*

VITALLY IMPORTANT FOR KEEPING PRODUCTION UP . . . COSTS DOWN . . .

Many elements in a piping system may contribute to ultimate fuel waste. Insulation may be inadequate. Piping and fittings may be at fault. Or valves may fail to hold tight . . . resulting in leakage of steam, air, or water, and in lowered pressures, all of which may mean excessive fuel consumption.

Lunkenheimer Valves—whether of steel, iron, or bronze—are quality built to stay tight, over years of service. They afford constant, dependable protection against leakage. Simplicity of design and a minimum of working parts assure extra long life and easy, economical maintenance.

We have prepared a chart, showing in dollars-and-cents figures, what leaky valves can waste in steam, water, and air. For a copy, write



FOR HELP ON ALL PROBLEMS OF MAINTENANCE OR OPERATION
Call your LUNKENHEIMER DISTRIBUTOR

Lunkenheimer Distributors have a wide practical experience and are fully equipped to give you valuable aid in solving your valve problems. Our Distributors are located in principal industrial centers. There's one near you—call on him.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

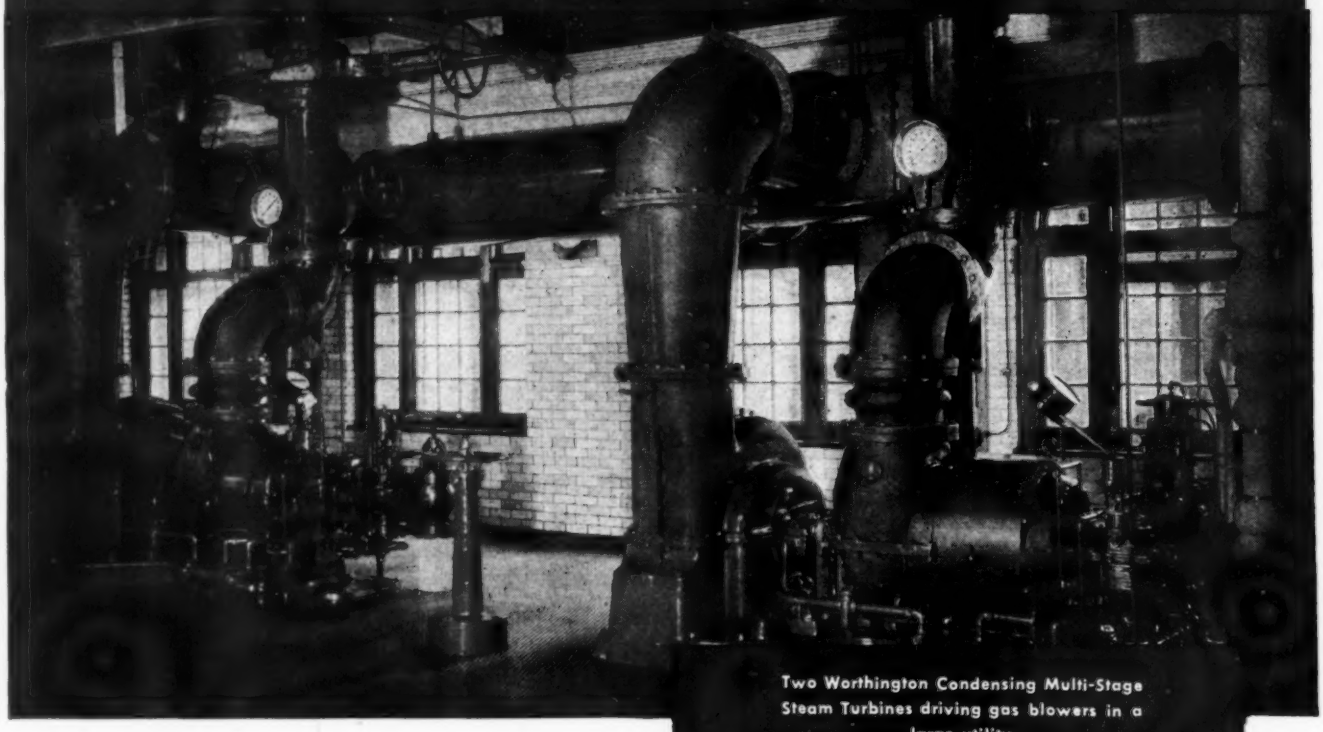
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.,
BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

MORE POWER FROM YOUR STEAM

. . . with Worthington Multi-Stage Turbines



Two Worthington Condensing Multi-Stage Steam Turbines driving gas blowers in a large utility.

You will want to investigate Worthington Multi-Stage Steam Turbines for either condensing or non-condensing service. Worthington's familiarity with all phases of steam power and specialized knowledge of Steam Turbine engineering account for *low maintenance* and *smooth, dependable economic operation.*

Low steam consumption is inherent in the design of these turbines, built in sizes from 100 HP to 10,000 HP for operation on high or low pressure steam and for speeds up to 9000 RPM. For full descriptive literature, write *Worthington Pump and Machinery Corporation, Harrison, N. J.*

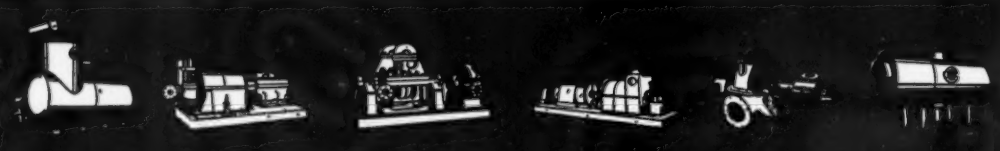
WHO USES THEM?

Worthington Multi-Stage Steam Turbines—condensing and non-condensing types — are now driving blowers, generators, pumps, line shafts, refrigeration compressors, air-conditioning units, paper machines, cane shredders, etc. Data that proves *there's more worth in Worthington* is available on request.

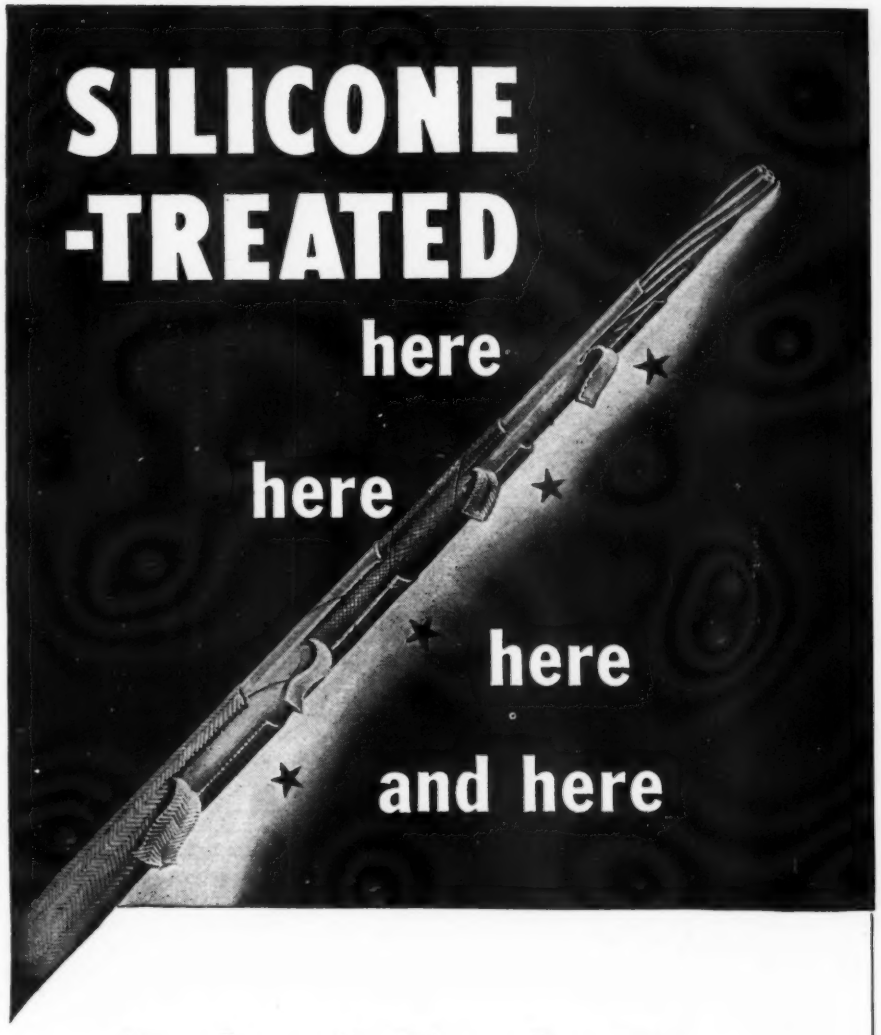
WORTHINGTON

T3-1

A GREAT TEAM IN STEAM



SILICONE -TREATED



to beat the heat up to 200 C

From the heat-resistant properties of General Electric silicone varnishes, a complete new line of Deltabeston* cables now gets extra heat protection in every layer of insulation. With such thorough silicone treatment, these cables are ready to help you beat heat problems in 600-volt service at temperatures up to 200 C (392 F).

A SILICONE-TREATED felted-asbestos layer gives protection against ambient heats. Another SILICONE-TREATED asbestos layer fights conductor heat. Between the two, a SILICONE-TREATED glass tape adds moisture resistance and dielectric strength. Then, an over-all abrasion-resistant glass braid is SILICONE-TREATED for extra toughness.

Also available now are silicone-treated Deltabeston cables for 300-volt service. Both 300- and 600-volt constructions are approved for use in the wiring of ovens or other high-temperature equipment, such as furnaces and control apparatus, where the acceptability of the wire for the particular use has been determined by the Underwriters' Laboratories, Inc.

For information, write to Section Y79-963, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

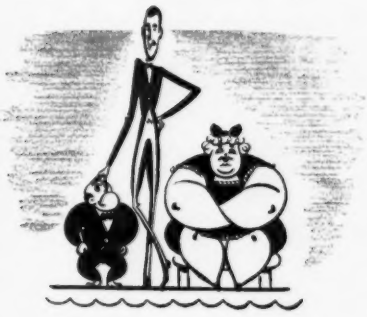
*Trade-mark Reg. U. S. Pat. Off.

DELTABESTON
wires and cables
built to beat the heat

GENERAL ELECTRIC

HI-AMBIENTS!

application hints from your Deltabeston Distributor

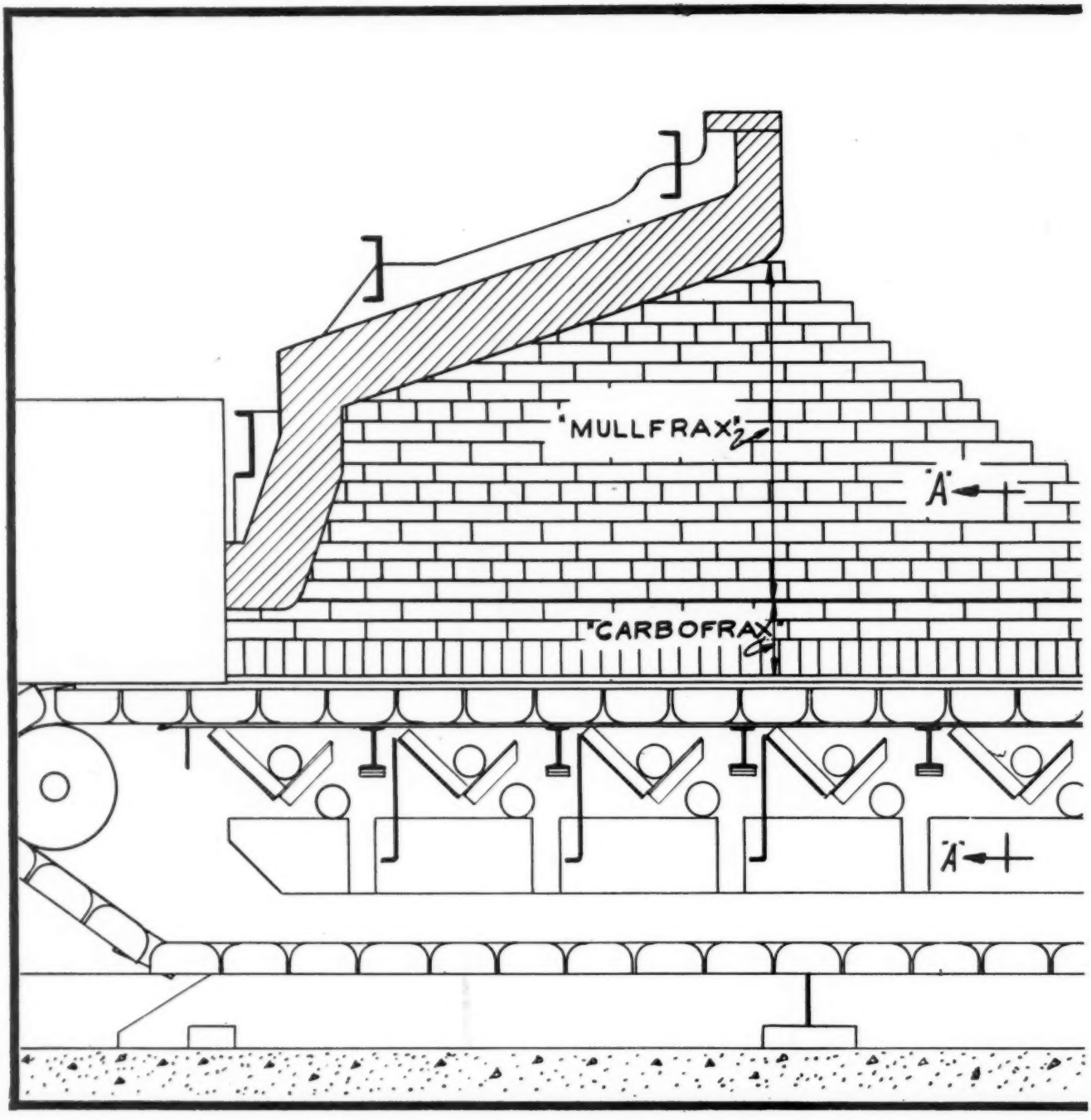


ALL SHAPES AND SIZES of glass and asbestos magnet wire are available in extra heat-beating form. Whether you do your own winding or have it done by an outside shop, make sure that all your winding jobs are done with Deltabeston.

MOISTURE RESISTANCE is only one of the long list of advantages Deltabeston power cable offers you. Like all Deltabeston products, it's a heat beater that can't be beat, because it's insulated with purified asbestos. Varnished cambric and heavy braid or lead sheath help resist abrasion, flame, grease, corrosive vapors, and oil.

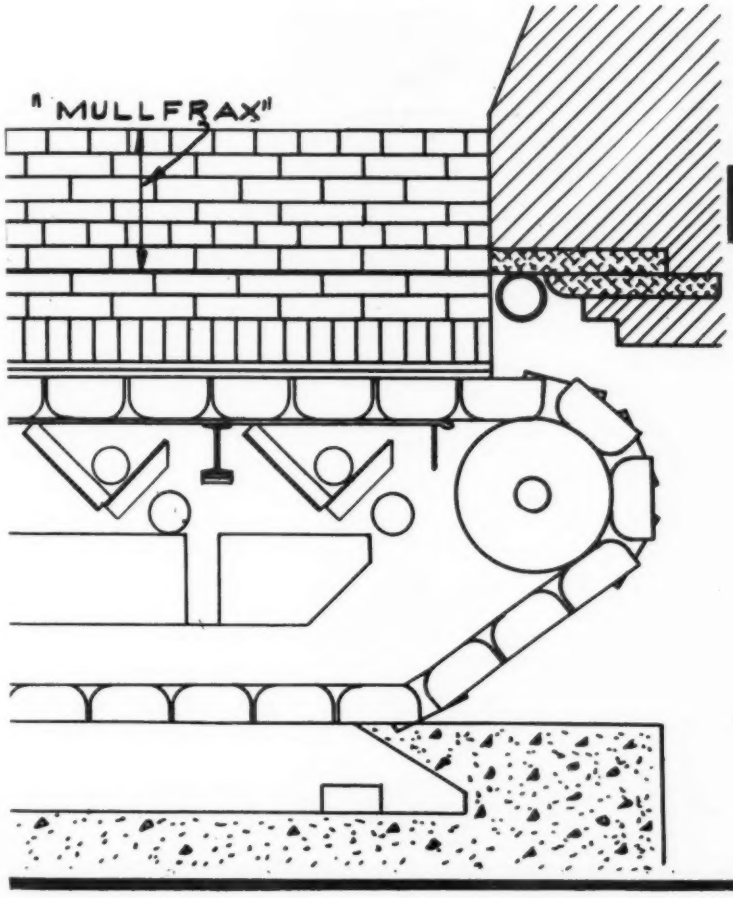
FOR INFORMATION on any part of the heat-beating Deltabeston line, get in touch with your General Electric merchandise distributor. He's got a solution for your heat problem, and he'll be glad to tell you about it.

A Super Refractories Combination



SUPER

that stands up to Low Fusion Ash Coals



Destructive slags from high pyritic sulphur coals are combatted successfully by using super refractories by CARBORUNDUM. Shown by the drawing is a typical application. Operating conditions, of course, determine actual heights of linings for specific installations.

CARBOFRAX silicon carbide brick are installed in the fuel bed zone where there is little likelihood of molten slag attack. They offer no anchorage for choking clinker accumulations. Their hard dense faces are kept clean by the moving fuel bed. Full grate area is available. Operation is more efficient. Greater steaming capacity is provided. Maintenance costs are cut. Because of high resistance to elevated temperatures, mechanical abrasion, spalling and flame erosion, CARBOFRAX brick last longer. Frequent repairs are eliminated.

MULLFRAX electric furnace mullite brick are installed above the CARBOFRAX brick belt in those sections where most severe conditions exist. They solve a dual problem. Remaining hard at high temperatures, these brick are impenetrable to any clinker formations resulting from variations in fuel bed depth. Accumulations are barred off easily, quickly without harming the brickwork. Resistant to fluid ash, chemically inert MULLFRAX brick retard erosion. Moreover, freedom from cracking and spalling helps insure superior performance-assists in promoting more continuous service.

This combination of super refractories by CARBORUNDUM steps up steam production . . . slashes maintenance expense in furnaces burning high sulphur, low fusion ash coals. Individually and in combination, they produce similar results in other applications. Use them on your next repair job. Investigate them for other jobs. Write Dept. G-97 for facts. The Carborundum Company, Refractories Division, Perth Amboy, N. J.

REFRACTORIES

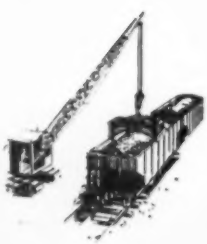
BY CARBORUNDUM

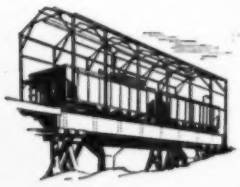
TRADE MARK

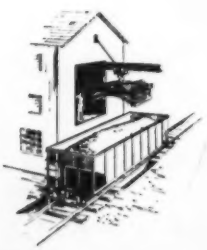
"Carborundum," "Carbofrax" and "Mullfrax" are registered trademarks which indicate manufacture by The Carborundum Company.

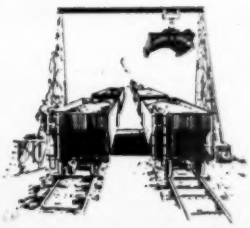
Now your frozen coal ca

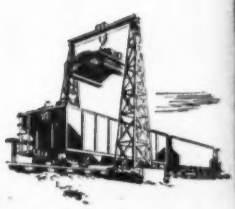
The Robins Car Shakeout is readily adaptable for use with any hoisting equipment











...be knocked out...cold!

New method unloads frozen hopper cars in <u>minutes</u> ...saves time, money and labor

It's the new Robins Car Shakeout! It unloads cars of frozen coal *and other bulk materials* with speed and efficiency never before believed possible.

And that should mean a lot to you—with winter and slow, costly unloading jobs on the way.

It saves hours of labor, too. The operator merely places this portable unit in position and pushes a button. The Shakeout does the rest. It shakes frozen material loose from the sides of the car... breaks it up... causes it to flow freely through the hopper doors . . . *without hand labor.*

No matter how solidly frozen or tightly packed the material, the Shakeout will unload it quicker and better than any other method. Supplemented, if necessary, by a small amount of heat for only 10 to 15 minutes, cars are emptied "broom clean" almost as quickly as in warmer weather.

Remember, too, that for your normal operations, the Robins Car Shakeout empties 50- or 70-ton carloads in as little as 90 seconds! This means that you can move emptied cars off your siding in a hurry . . . save the expense of demurrage charges *. . . with no damage to cars, no danger to the operator.*

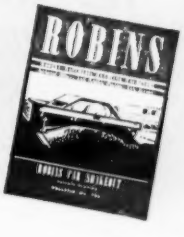
Continuous field operations by scores of users prove that this method of unloading hopper cars—containing coal, coke, ore and other bulk materials—is as much as twelve times faster than manual unloading.

Plan now to speed all your unloading—and especially this winter—with a Robins Car Shakeout. Send coupon below for free descriptive booklet. Or write Robins Conveyors Division, Passaic, N. J.

ROBINS CONVEYORS DIVISION, HEWITT-ROBINS INCORPORATED
PASSAIC, N. J.

ROBINS CAR SHAKEOUT

FREE! New 8-page booklet tells how the Robins Car Shakeout saves you time, money and manpower. Illustrates and describes actual results in the field. Send coupon below for your copy of free booklet—<u>now!</u>



Robins Conveyors Division (Dept. S-2)
Hewitt-Robins Incorporated
270 Passaic Ave., Passaic, N. J.

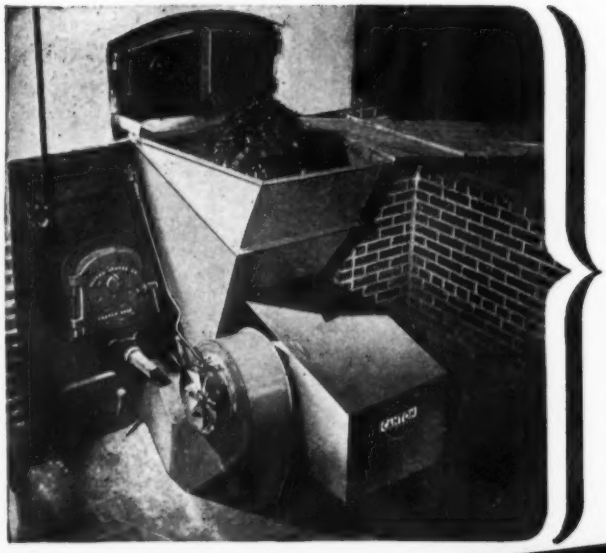
I want to know more abput the Robins Car Shakeout and how it will speed up my coal car unloading. Please send me a free copy of your new booklet.

NAME_____

FIRM_____

BUSINESS ADDRESS_____

CITY_____ ZONE_____ STATE_____



BIG SAVINGS WITH COAL OVER OIL

AT THE VICTOR SILK HOSIERY COMPANY

Mr. E. Albin Drechsel, Vice President of Victor, pays their Canton LO-SET Ramfeed Stoker a fine tribute, saying, "There has been definitely a cash saving to us . . . We can now carry a full head of steam with a capacity load . . . it has never given us any trouble and under present conditions WE WOULD NEVER THINK OF GOING BACK TO OIL."

CANTON STOKER

Performance?

LET'S GET DOWN TO CASES

LOW COST STEAM – UNIT HEATING COST 20c Per Day

AT MORIN HEIGHTS HOUSING PROJECT, WOONSOCKET, R. I.

Three boilers fired with Canton LO-SET Ramfeed Stokers furnish heat and hot water from a central heating plant to the 300 housing units at the Morin Heights Housing project. George Fleurant, superintendent, heartily endorses the Canton Stokers stating, "they are standing up one hundred per cent . . . our test runs prove that only 6½ tons of coal are used in sixteen hours, with ACTUAL COST ABOUT TWENTY CENTS PER DAY for each housing unit."

CONTINUOUS OPERATION – HEAVY OVERLOAD CARRIED WITH NO SHUTDOWNS

AT COPPERWELD STEEL COMPANY, WARREN, OHIO

A 450 H.P. heating load, seventeen pickling tanks and a thousand ton press require large quantities of steam at Copperweld Steel. While awaiting delivery of the 3rd and 4th boilers during the winter of 1942-43, two of the four Canton Stokers purchased were on the line continuously—no let-down was possible. Mr. Morgan, chief engineer reports, "In periods of heavy demand with wide fluctuations, steam pressures held constant."

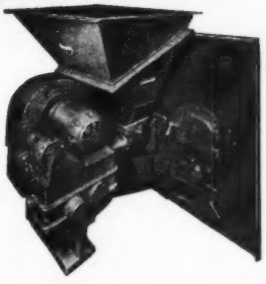
CANTON STOKERS SAVE VITAL FUEL, MANPOWER AND TRANSPORTATION

CANTON STOKER

. . . SOME TYPICAL EXAMPLES OF CANTON'S EFFICIENCY, DEPENDABILITY AND ECONOMICAL SERVICE . . . .

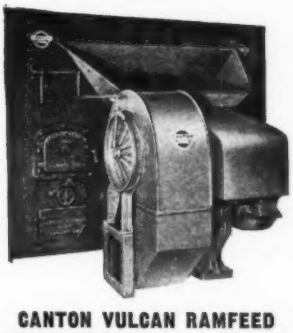
54 TYPES AND SIZES FOR EACH NEED UP TO 800 H.P.

Canton Ramfeed and Wormfeed Stokers are literally engineered for each specific job. You can be certain after thorough analysis of your need, that the Canton model selected will meet all requirements.



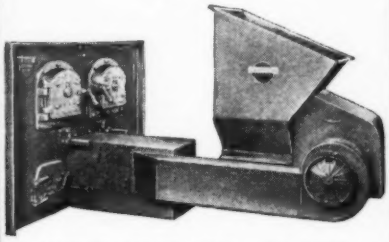
CANTON UNIFLEX RAMFEED

Compact arrangement—front motor mounting, separate fan drive—engineered for limited space installations.



CANTON VULCAN RAMFEED

Ruggedly constructed and engineered for heaviest loads — also available in LO-SET models. Famous for carrying high overload capacities.



CANTON DELUX UNIT WORMFEED

Side dump stoker — front fan mounting — zoned air control — especially adaptable to converting existing boilers to stoker firing.

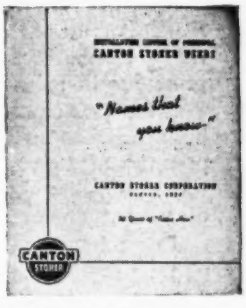
The three installations described are being duplicated in hundreds of plants where Canton Stokers serve—top efficiency, fuel saving, labor conservation and low maintenance costs are the qualities that make Canton Stoker a "best buy."

CANTON STOKERS *Guaranteed* 5 YEARS

Reflecting the rugged design and sound engineering is the EXCLUSIVE 5 year Canton Guarantee—a guarantee covering not only defects but wear itself. Canton Stokers are the ONLY stokers offering this protective bond.

HUNDREDS OF SATISFIED CUSTOMERS

Indicating the success of Canton Stokers "on the job" is the list of "famous name" plants Canton Stoker equipped — Send for your copy of this interesting twelve page brochure today.



Now **IMMEDIATE DELIVERY FROM STOCK**

TO REPLACE OIL, GAS, OR HAND FIRING EQUIPMENT

Send Today for Descriptive Literature and Cost Saving Facts

THERE ARE 32 YEARS OF *"Know How"* BEHIND CANTON STOKERS

★

Representatives In Principal Cities

CANTON STOKER CORPORATION

741 ANDREW PLACE, S. W., CANTON, OHIO

Gentlemen:

---Please send all descriptive literature at once

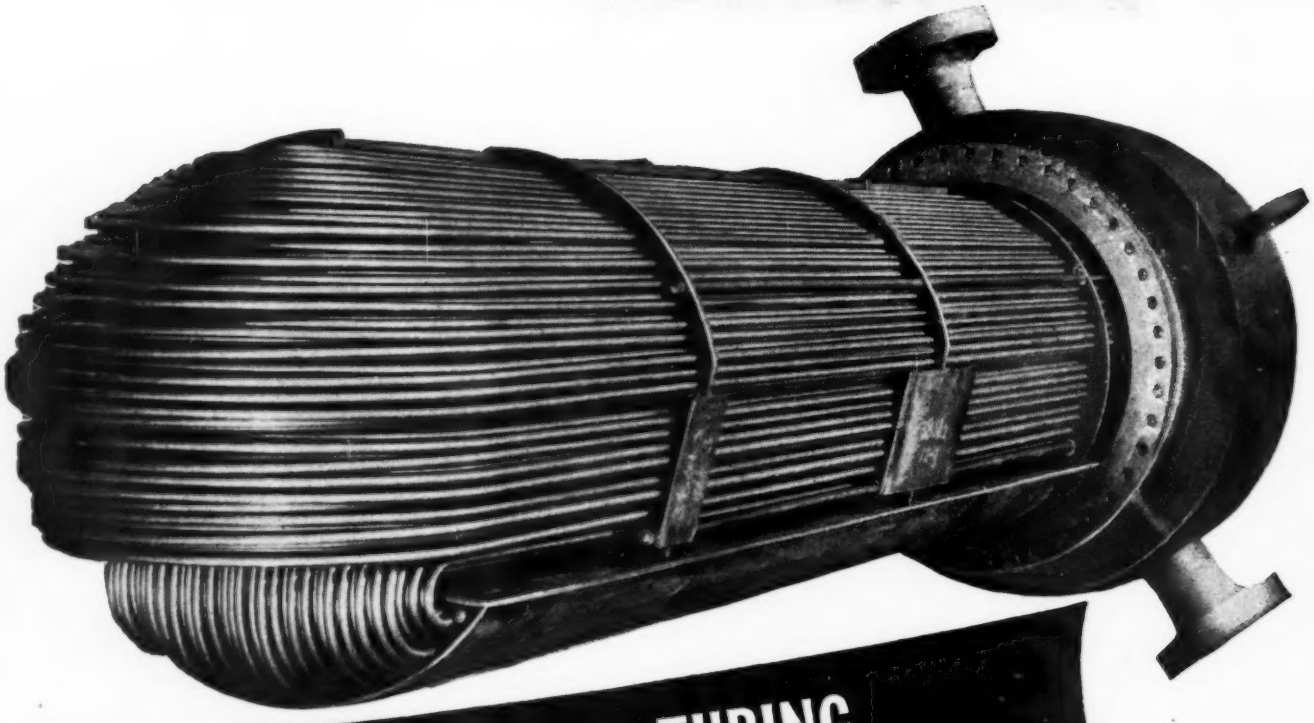
---Have a CANTON Engineer interview us immediately

Name ----------

Company ----------

Address ----------

City---------- State----------



0.065" WALL TUBING HANDLES FEEDWATER AT 1300 P.S.I.

Here's another example of how Monel* helps solve the problems created by soaring temperatures and pressures in modern power plants...

Griscom-Russell Company's Massillon, Ohio plant built this new final-stage preheater for a tube working pressure of 2000 p.s.i., using No. 16 B.W.G. (0.065" wall) annealed Monel tubing of 3/4 inch outside diameter.

This thin-walled, corrosion-resistant Monel tubing permits preheating 439,000 pounds of feedwater per hour, from 345° to 410° F., with steam bled into the shell at 675° F. Boiler operates at 915° F. and 1225 p.s.i.

Strength of Monel greatly exceeds that of other non-ferrous tubing materials, thus permitting thinner tube walls and larger inside diameters. Result is good heat transfer with minimum pressure drop.

Even at elevated temperatures, Monel resists corrosion and offers a smooth, clean surface that retards formation of heat-obstructing jackets of scale and deposits.

In addition, Monel's hardness resists erosive wear, and its ductility allows expanding the tubes into snug-fitting, durable connections with the head.

The extraction heater above . . . actually a repeat order from the Narragansett Electric Company, Providence, R. I. . . . confirms the high efficiency of a similar Monel-tubed unit serving their Manchester Street Station since 1941.

• • •

Other installations of Monel tubing in high-pressure power stations:

At the Twin Branch plant of Indiana and Michigan Electric Company, subsidiary of the American Gas and Electric Service Corp., Monel tubing was installed in a preheater handling 550,000 pounds of water an hour at 3200 pounds pressure per square inch—under external temperature of 637° F.—feeding a boiler operating at 2500 pounds steam pressure!

In the Oswego plant of the Central New York Power Corp., Monel heater tubing was installed to operate under 2000 pounds water pressure, at an outside temperature of 770° Fahrenheit.

If you have problems involving metals for equipment now in production or planned, consult INCO Technical service . . . make use of the wide experience of our engineering staff. Write:

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall Street, New York 5, N. Y.*

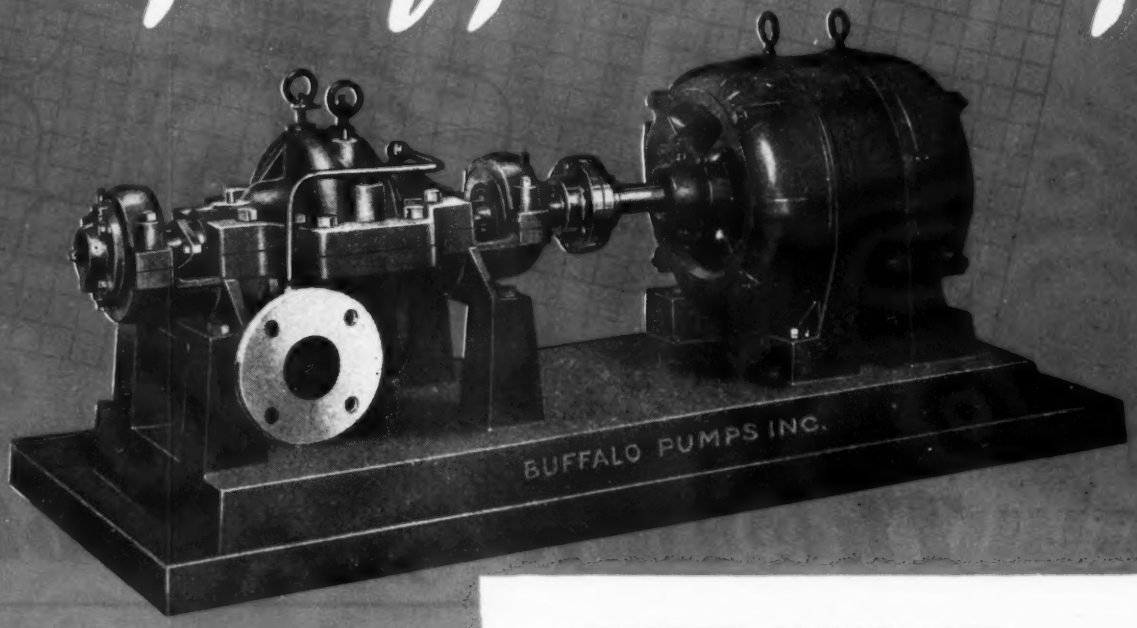
EMBLEM OF SERVICE

NICKEL INCO TRADE MARK **ALLOYS**

MONEL • "K"* MONEL • "S"* MONEL • "R"* MONEL • "KR"* MONEL • INCONEL* • NICKEL • "L"* NICKEL • "Z"* NICKEL

*Reg. U.S. Pat. Off.

WHY COST-CONSCIOUS OPERATORS *Specify This Pump*



"Buffalo"

CLASS "RR" PUMPS

- FOR CLEAR WATER, ANY TEMPERATURE
- FOR FEEDING BOILERS OR SIMILAR PRESSURE JOBS
- 10 TO 20,000 G.P.M.

LONGER PUMP LIFE MEANS LONG-TERM ECONOMY

When you come to actually analyzing pumping costs, it becomes readily evident that *year-after-year maintenance* costs, not initial costs, are the budget-balancers or budget-breakers; That's why "Buffalo" Pumps are designed to *keep delivering* at original rated capacity. Consider, for instance, these "wear insurance" features in the Buffalo "RR" line:

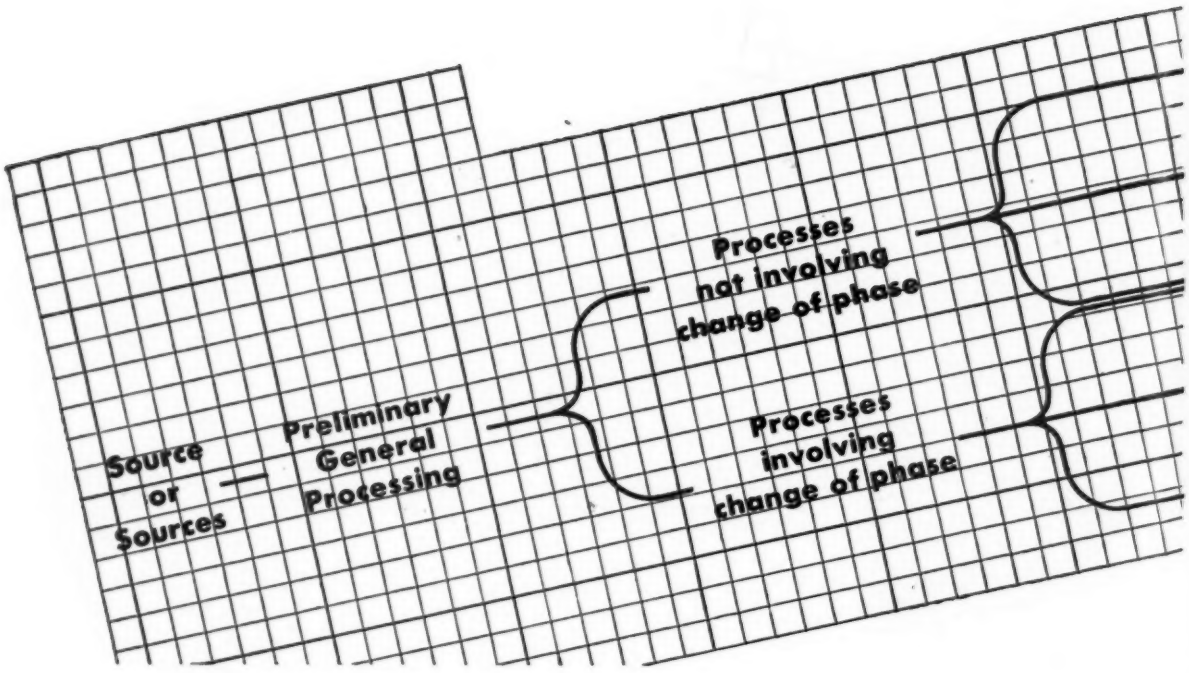
1. **EQUALIZED EXPANSION AROUND THE SHAFT . . .** due to the cast semi-steel casing, divided on horizontal centerline and mounted on centerline supports.
2. **HYDRAULIC BALANCE.** Buffalo engineering places enclosed mixed-flow single suction impellers back-to-back for this efficiency feature.
3. **WEAR-WORTHY BEARINGS,** well over-size, contained in dust-proof housings.
4. **SIMPLE DESIGN,** which means fewer moving parts to wear out, as well as easier servicing.

Full details are yours for the writing in Bulletin 980-A. Why not write for it today?

BUFFALO PUMPS, INC.

488 Broadway Buffalo, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.


Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

The Hall system of

Whenever water *changes phase,* and is converted into steam, the consequent concentration of impurities in the remaining water introduces new problems in water conditioning. In the modern steam boiler, with its high temperatures and pressures which result in greater reactivity of chemical substances, problems of foaming, corrosion, and scale are especially acute and these problems are the major factors in determining the method of water treatment which must be employed.

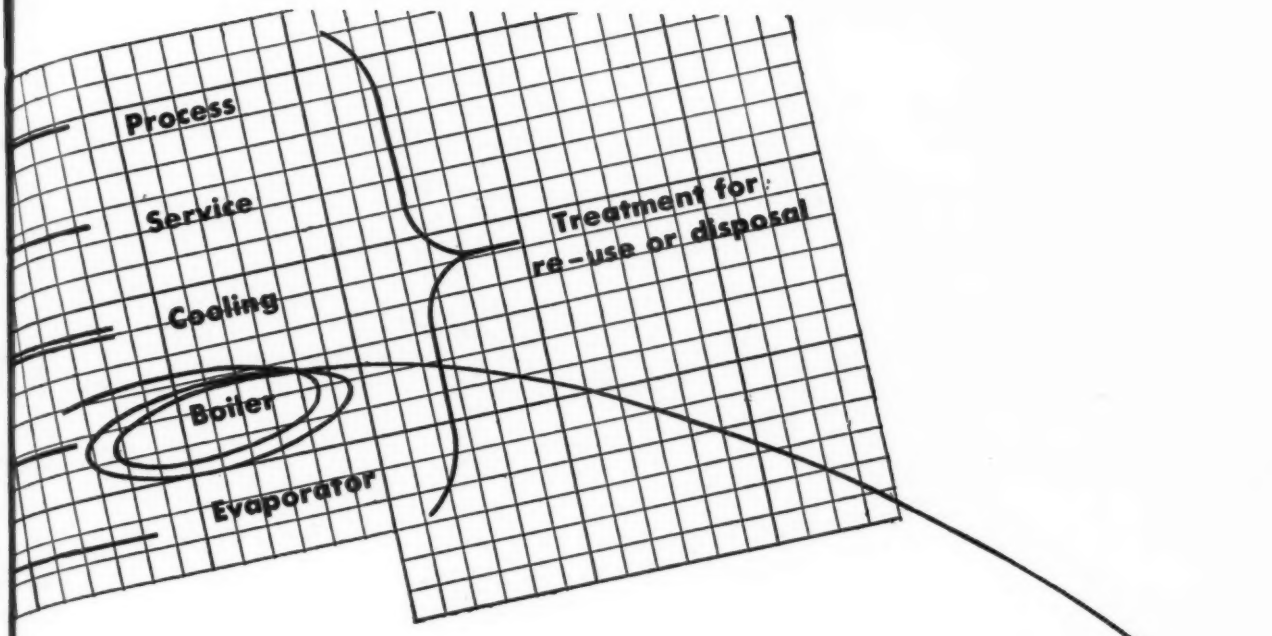
The Hall system of boiler water conditioning is based primarily on two facts concerning the mechanism of scale formation, established by Hall nearly 25 years ago: (1) When water contains substances whose solubility decreases with increase in temperature, these substances deposit as adherent scale at heating surfaces, and (2) the formation of adherent scale occurs *in situ*—that is, the constituents of scale are deposited directly on the heating surfaces as scale, not as particles free to move in the boiler water, which later form scale by chance agglomeration.

The principle of treatment derived from these two facts is the maintenance in the boiler of certain essential chemical equilibria, so that substances are formed which precipitate as sludges in the circulating boiler water and not at heating surfaces.

Since both feed water and boiler conditions vary almost from hour to hour, Hall Laboratories provides continuing service, designed to keep boilers "on the line." Here's what the Hall boiler-water-conditioning client gets:

1. Thorough study of all factors concerning water involved in producing steam in his plant.
   Boiler temperatures, pressures, ratings, circulation, and other factors must be taken into consideration —not merely the constituents of the feed water.
2. Procedure for the proper treatment of his boiler water.
   A definite program of treatment and testing to maintain the required chemical equilibria, and of control of blowdown and other matters related to proper functioning of the boiler.
3. Instruction of designated employees in making essential control tests.

HAGAN
HALL
BUROMIN
CALGON



boiler water conditioning

When proper conditions have been established, they must be maintained, in spite of variations in feed water and changes in operating conditions. Any boiler operator can, after instruction, follow the simple test routine developed by Hall chemists.

4. Periodic check of his plant by Hall service engineers. Experience gained in frequent contacts with hundreds of plants of all types and sizes is brought to his plant by these men, and often enables them to detect conditions that might easily be overlooked and cause trouble.
5. Periodic checking of samples by Hall Laboratories. This is his assurance that testing at his plant is being carried out according to instructions.
6. "Trouble shooting" as problems arise.
   If trouble does occur, Hall engineers, backed by Hall facilities for thorough analysis of waters, scales, sludges and metals, and by the detailed knowledge of Hall research men, are prepared to trace it to its source, and give all possible help in correcting it.

* * * * * * * *

The work of Hall Laboratories in the field of boiler water conditioning led almost inevitably to the study of other industrial water problems, and today every problem concerning the use of water in industry, from selection of sources to ultimate disposal of waste, comes within the scope of its service. Hall Laboratories is prepared to recommend procedures in industrial water conditioning which, taking all factors into account, represent the most efficient and economic solution *in your specific situation.*

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

HALL LABORATORIES, INC.

(A Subsidiary of Hagan Corporation)

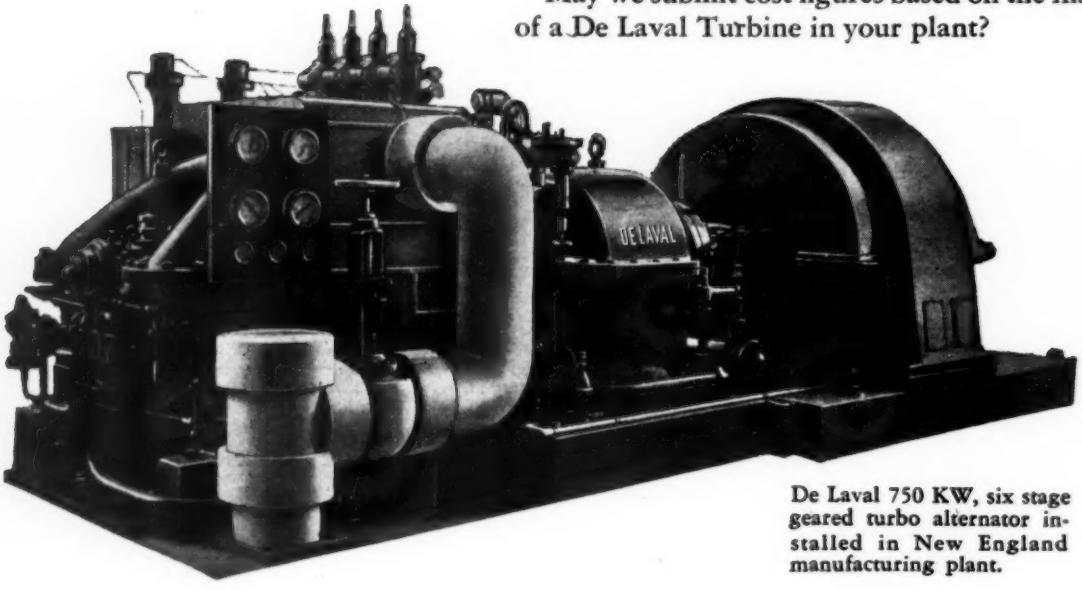
CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

where there is HEAT there is POWER

Don't overlook the economy of generating your own power with a De Laval turbine wherever appreciable quantities of steam are required for heating buildings, dryers or processes.

In many installations the entire cost of the turbo-generators and auxiliary equipment has been repaid in two or three years. In fact, the installation of a modern high pressure steam plant often results in the production of both power and process steam at a fuel cost no greater than that entailed for the production of process steam alone, with older equipment.

May we submit cost figures based on the installation of a De Laval Turbine in your plant? T-6



De Laval 750 KW, six stage geared turbo alternator installed in New England manufacturing plant.

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TRENTON 2, NEW JERSEY

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SEPTEMBER 1947 VOLUME 91, NUMBER 9

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

FEATURE ARTICLES

How to fire gas and oil fuels without smoke 64
Large generators prove themselves 69
Survey of feedwater practice in German plants 72
Problems in atomic-power engineering 77
Tips for the air-conditioning engineer 80
Pressed fit on crankshaft stops overhung-flywheel wobble 84
Mercury-pool rectifiers supply dc when and where you want it 86
New plant ties into old one without interruption 89
Rebuilt boiler setting improves performance, reduces maintenance 92
Annual meeting of National District Heating Assn 94
Albert L Cole: a power personality 95
120-ton generator rises to the roof 98
"Bombproofs" for rocket-motor tests 102
How to select a control valve 103

THE OPERATING ENGINEER

Air cooling extends furnace-wall life 107
Practical aids to plant operation 110
Reader's problems 114
Math tips 126
Pump Q and A 120
"How to—" 128

OTHER DEPARTMENTS

New plant equipment 130
Power news 142
Data sheet 138
Engineer's bookshelf 144
George Edwards 140
New bulletins 190a

Cover photo, courtesy of Westinghouse Electric Corp.

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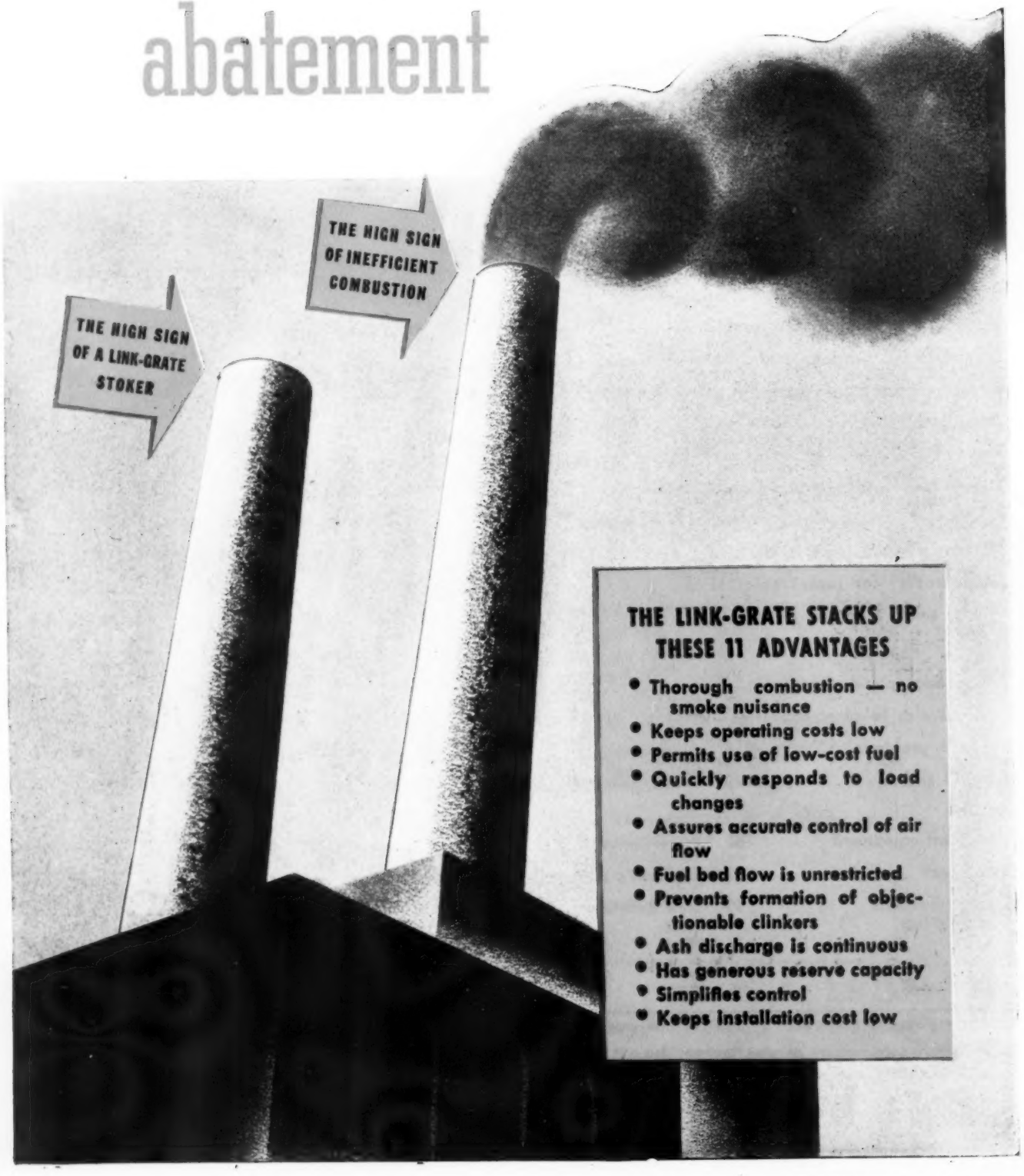
Three cheers for smoke abatement

1 ...from your fuel cost sheets



THE LINK-GRATE STACKS UP THESE 11 ADVANTAGES

- Thorough combustion — no smoke nuisance
- Keeps operating costs low
- Permits use of low-cost fuel
- Quickly responds to load changes
- Assures accurate control of air flow
- Fuel bed flow is unrestricted
- Prevents formation of objectionable clinkers
- Ash discharge is continuous
- Has generous reserve capacity
- Simplifies control
- Keeps installation cost low

2...from your Smoke Inspector

3...from your neighbors

Get all 3 with a Westinghouse Link-Grate Stoker

Smoke abatement means much more to you than to an outsider interested only in cleanliness. To you, it means more steam per pound of coal—more of your coal turned into heat, and less of it "up the flue" as soot.

You get these advantages with a Westinghouse Link-Grate Stoker because of its characteristic action. This action maintains a regular combustion rate by continuously processing the fuel bed to keep it porous. With this action, a positive motion at the rear of the stoker permits a uniform flow of coal over the underfeed section, to keep the burning lanes open.

In Link-Grate action, the grates first hinge upward to break open the fuel bed and let low-pressure air flow through the grates. The reverse movement of the grates crumbles and conveys the burning fuel.

Another effect of this Link-Grate action is the continuous ejection of the ash off the discharge plate—to do away with periodic dumping and to reduce labor costs. Clinkers are not a problem.

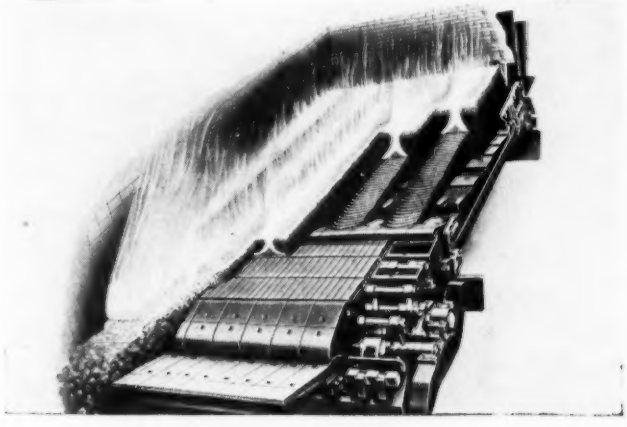
Since this action keeps the fuel bed always porous, the Link-Grate Stoker can meet suddenly increased steam demands quickly with full combustion efficiency.

Get the complete information about the Link-Grate before you make another investment in stokers. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a user. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-50470

Show Link-Grate Movies in Your Own Office

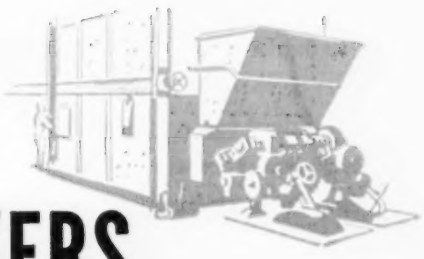
A 15-minute sound moving picture has been produced to show in detail the operation of a Link-Grate Stoker. Whether you can visit an actual Link-Grate Stoker in operation or not, this interesting 16 mm. film will show you its action and explain its points of superiority while you sit at your desk. To borrow a print of this film for your own private showing, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



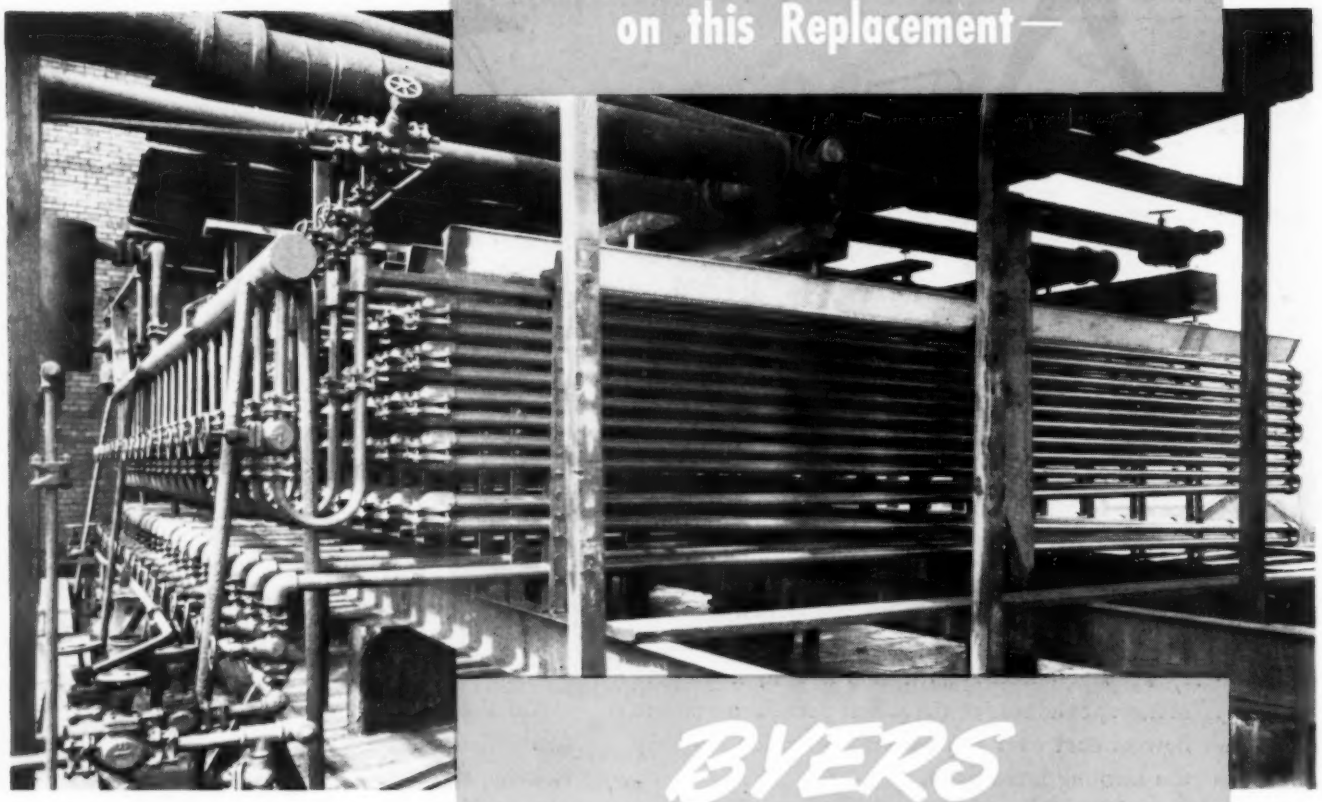
Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Link-Grate STOKERS



Service Records Dictated "Specs" on this Replacement—



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When this condenser was rebuilt, there were no debates or delays in the matter of material selection. The old condenser, built of genuine wrought iron, had given more than 20 years of trouble-free service, and this splendid record dictated the new specifications. Byers Wrought Iron pipe was installed.

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You'll find the reason for wrought iron's superior durability in its unique structure and composition. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack. The fibers also help anchor the initial scale, which shields the underlying metal.

Our bulletin, "Wrought Iron in Refrigeration and Air Conditioning Systems," will give you some helpful information. Ask for a copy.

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POWER

PHILIP W SWAIN, EDITOR • SEPTEMBER 1947 • ESTABLISHED IN 1882

Make the Dollars Work Harder!

EVER SINCE the early days of commercial power production, two contrasting trends have been evident. The *cost* of every major element entering into production has *increased*; the *price* of power to the consumer has *decreased*. The forces that made this possible are the forces that must have free rein in the national economy today if we are to survive the spiral of higher costs and higher prices.

Let's look at the record. It has been carefully analyzed in a thought-provoking paper presented before the Edison Electric Institute by William F Ryan, assistant engineering manager, Stone & Webster Engineering Corp. This paper is the source of the figures used here.

Take the case of fuel. Prices have fluctuated violently since 1900, with an all-time high in 1920, and fuel now costs two and a half times what it did in the years before World War I. But, and this is an important *but*, a ton of coal today produces close to three times as many kwhr as it did back in 1915. The engineer has thus more than offset rising fuel prices by continued improvements in the art of burning fuel and utilizing the heat released.

The record on labor is nearly as remarkable. Today labor rates stand at an all-time high—almost five and a half times what they were in 1915. At that time, however, a man-year of labor produced only about 225,000 kwhr, while by 1943 productivity had been boosted to about 1,125,000 kwhr, a rise sufficient to compensate for cost increases to that date. Although labor rates have continued to increase from 1943 to date, productivity has fallen off, a discouraging and perhaps ominous sign.

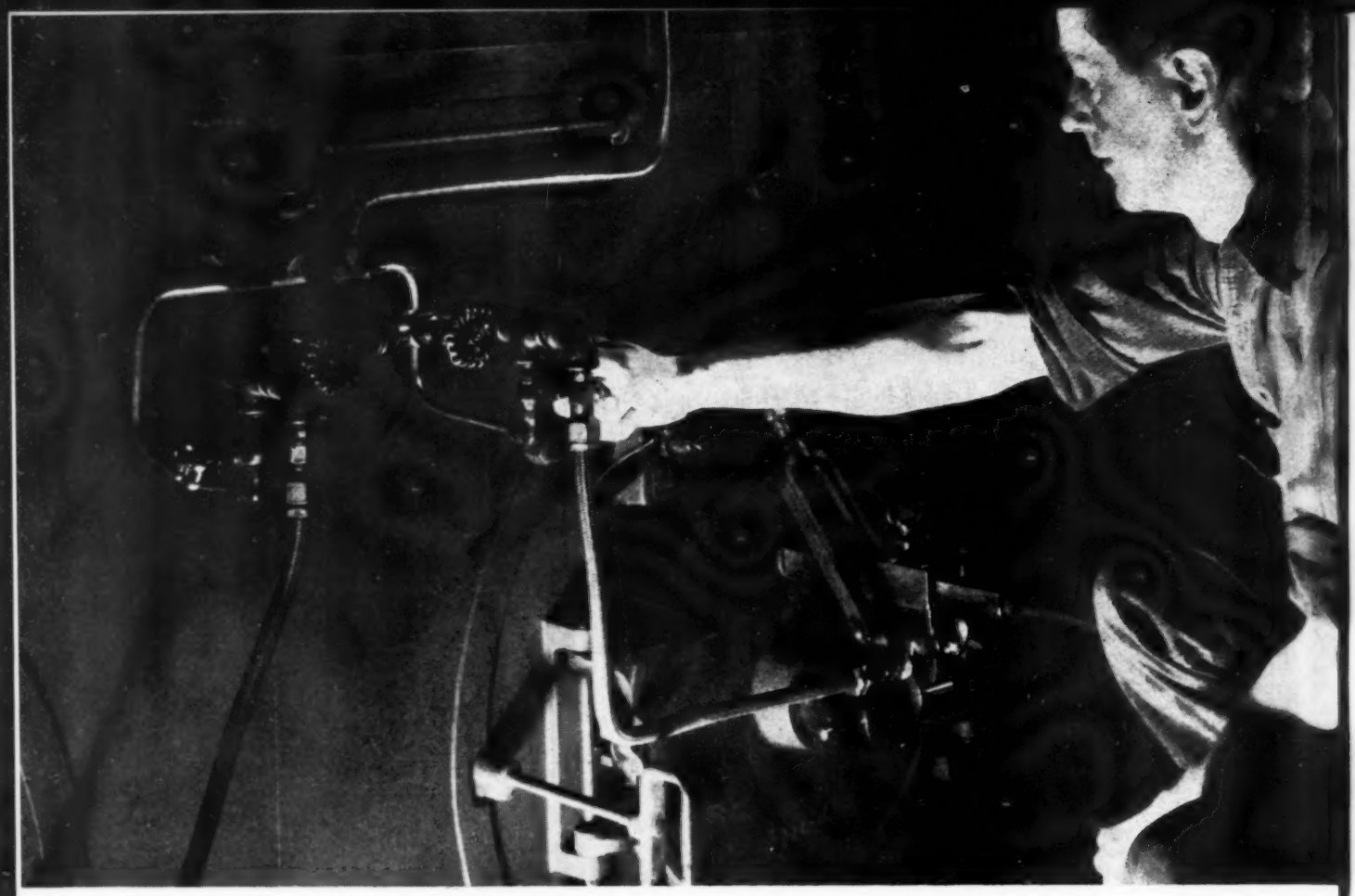
When we come to what is usually the largest single element of power cost—fixed charges on investment in plant and equipment—analysis becomes difficult. Nevertheless, the evidence indicates that elements of construction cost (labor, materials and equipment) now average close to four times what they did in 1914. But engineering advances help to offset this rise. Higher pressures, temperatures, speeds and heat-transfer rates of modern equipment yield higher output per unit of space and weight. Simplified plant layout reduces amount of equipment and building volume. As a result, the rise in cost per kw of plant capacity has been less rapid than that of the elements of construction cost, because the modern plant can be built with fewer pounds of materials and labor hours. Based on actual data for a representative sample of steam-power stations, a given amount of capacity is about two and a half times as expensive today as in 1914.

With a certain sum invested in plant, cost of its operation depends on how effectively it is utilized and how much must be paid for the use of money. Intelligent sales and rate policies have so improved utility-system load factors that a kw of capacity generated 4600 kwhr in 1944 against 3000 kwhr in the period from 1915 to 1920. This figure is expected to reach 4700 kwhr this year, after a slight dip in 1945 and 1946. Further improvement in the fixed-charge picture comes from the present relatively low cost of money.

With the exception of the influence of interest rates, every rise in power-production costs has been offset by corresponding gains in the productivity of fuel, labor and investment dollars. These advances didn't just happen. They result from: (1) constant engineering search for improved equipment and methods (2) unreserved willingness to back engineering judgment with capital, and (3) marketing policies that encourage greater volume at lower prices.

It should be remembered as well that the labor situation in the power industry has been relatively favorable in two respects: (1) Amount of labor needed and the productivity of that labor is largely determined by the technical factors of plant design and operating technique, and (2) there has been less opportunity for the artificial restrictions on labor productivity that have plagued some other fields.

This record, which the industry may well be proud of, forms a practical lesson in economics that is badly needed today. *Our economy can support higher wages and salaries only if productivity of labor and capital increase proportionally.* No part of our job as engineers and managers carries more importance to us and the nation than this particular one. With the skill and ingenuity that have always marked the work of power engineers, let's make the record of the years ahead as good as that of the past.



How to Fire Oil or Gas Without Smoke

Good equipment, properly installed and operated, spells complete combustion and clean stacks. Here are basic data on the burning habits of hydrocarbons, gas and oil burners, and furnaces, plus practical pointers on operation and maintenance

By L N ROWLEY, *Managing Editor*, and J C McCABE, *Assistant Editor*

► MORE THAN ANYTHING ELSE, pollution-free stacks depend on clean, complete combustion. In turn, good combustion depends on proper equipment, properly installed and operated. Let's see what this means for gas and oil.

In dealing with these fuels, we have much to do with *hydrocarbons* so we will review very briefly the principal properties of these compounds of hydrogen and carbon. Their number is practically infinite, but they fall into clearly defined groups differing in the number of hydrogen atoms to each carbon atom and in the way these atoms are arranged in the molecule. For example, the paraffin series has the general formula C_nH_{2n+2}, which means that for every carbon atom there are twice as many hydrogen atoms, plus two. For one carbon atom, we have $(2x1) + 2 = 4$ hydrogen atoms, which is the common gas *methane*, CH_4. Starting with two carbon atoms, we have $(2 \times 2) + 2 = 6$ hydrogen atoms, or C_2H_6, *ethane*.

Other hydrocarbon series, or families, differ in the general formula as, for example, the *naphthene* series, with the formula C_nH_{2n}. Generally, the lightest compounds (those with lowest number of atoms) are gases, the next heavier compounds are liquids, and the heaviest solids.

Fuel Oils. Fuel oils used commercially are mixtures or blends of a large number of hydrocarbons together with certain nitrogen, oxygen and sulphur compounds as well as some mineral impurities. The composition in any case

depends on the crude from which the fuel oil is refined, and the refining process. To begin with, crude oils are hydrocarbon mixtures and, according to their source, differ in the nature of the hydrocarbons. Thus, some crudes are high in paraffin, others naphthenes, etc.

Refining consists of separating and, usually, recombining, the hydro-carbons of the crude oil into specialized products like gasoline, fuel oil, etc. The basic process is simple distillation, which separates the hydrocarbons into groups or "fractions" having the same range of boiling points. Ranging from light to heavy, typical fractions are: (1) naphtha (2) gasoline (3) kerosene, and (4) gas oil. These are the *distillates:* the remainder of *residue* is a heavy fuel oil. Products of simple distillation are called *straight run.*

Simple distillation is sometimes the whole story, but in modern refining it is only the beginning. To secure greater yields of gasoline, fractions heavier than gasoline are usually *cracked*: decomposed by heat and pressure with or without the presence of a catalyst. Of the new hydrocarbons resulting, some are lighter and some heavier; these are likewise separated according to boiling range. Cracking, unlike simple distillation, actually changes the hydrocarbon structure so crude oil yields much more of the valuable lighter hydrocarbons (gasoline) and proportionately less of the heavier ones.

Fuel oils used commercially may be either distillates or residuals and either straight-run or cracked. Straight-run products become increasingly less common as refinery practice leans more heavily on cracking and are, in general, premium grades. Thus the great bulk of commercial fuel oils are cracked products; distillates form the source for the lighter grades of oil used in domestic and some small commercial and industrial burners, whereas residuals supply the heavy oils for larger commercial and industrial burners.

Fuel Gases. Natural gas is the only gaseous fuel of importance in the power field. It consists, like fuel oil, of a mixture of hydrocarbons, in which methane predominates. The other fuel gases, either byproduct or manufactured, differ in that hydrocarbons play little or no part in their composition. The major fuel elements are usually uncombined hydrogen and carbon monoxide, with nitrogen and carbon dioxide as "inert" constituents.

If we understand clearly how hydrocarbons burn we have the key to smokeless operation with fuel oils and natural gas. The preceding article ("How Fuels Burn," POWER, Aug. 1947, pp 71-73) outlined the general combustion process with particular emphasis on the three T's—time, temperature and turbulence. Now our job is to fill in some additional details on the burning habits of hydrocarbons.

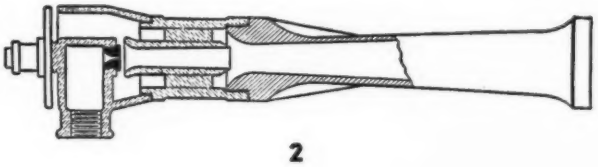
Burners. Before we can have combustion, fuel and air must be prepared for it—this is the job of the burner and the auxiliary equipment. For gas fuels, the task is relatively easy since the fuel is already in the gaseous state essential to combustion. Gas burners thus need only proportion the volume of gas and air delivered to the furnace and insure thorough mixing. In some designs, Fig. 1, gas and air do not mix until after they have left the burner but usually a considerable amount of premixing occurs between gas and primary air, as in the burner of Fig. 2.

Oil burners and auxiliaries, in addition to proportioning fuel and air, and mixing them, must prepare the oil for combustion, that is, convert it to the gaseous state. There are two ways of doing this, with many variations of each: (1) The oil may be vaporized or gasified by heating within the burner or (2) it may be atomized by the burner so the vaporization can take place in the combustion space and as part of the burning operation. Burners of the first group, usually called *vaporizing burners,* are necessarily limited in the range of oils they can handle and find little application in the power field.

If the oil is to be vaporized in the combustion space in the instant of time available, it must be broken up into many small particles to expose as much surface as possible to the heat. This *atomization* may be effected in three basic ways: (1) by forcing oil under pressure through a suitable nozzle, as in the familiar "gun" type burner, Fig. 3, (2) by tearing an oil film into drops by centrifugal force, as in *rotary-cup* burners, Fig. 4, and (3) by using steam or air under pressure to break the oil into droplets, as in *steam-atomizing* burners, Fig. 5.

In addition to breaking the oil into particles for fast vaporization, the burner must provide motion between oil

PREMIXING AND NON-PREMIXING GAS BURNERS



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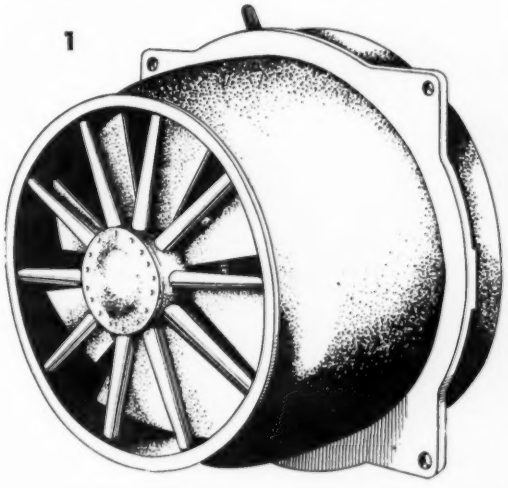

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Fig. 1—High-pressure fuel gas, issuing from jets in the spider of this gas burner, rotates the spider by reaction, driving the fan. Air drawn in by fan mixes with gas issuing from jets. Resulting turbulence produces extremely rapid, thorough mixing. Shutter adjusts fuel-air ratio. Fig. 2—In premixing burner, high-pressure gas flows through two venturi sections in series. Primary air enters through a shutter at the left and is mixed with the gas by induction. In burners of this general type part or all of primary air is premixed in this manner.

THREE BASIC METHODS OF OIL BURNER ATOMIZATION

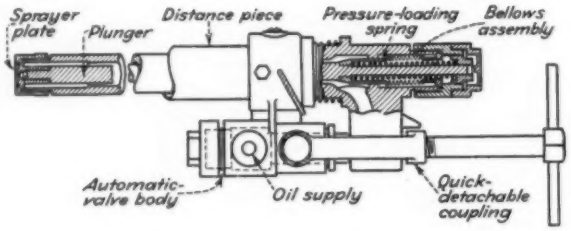


Fig. 3—In mechanical-atomizing burner, oil under high pressure is forced through the nozzle for atomization

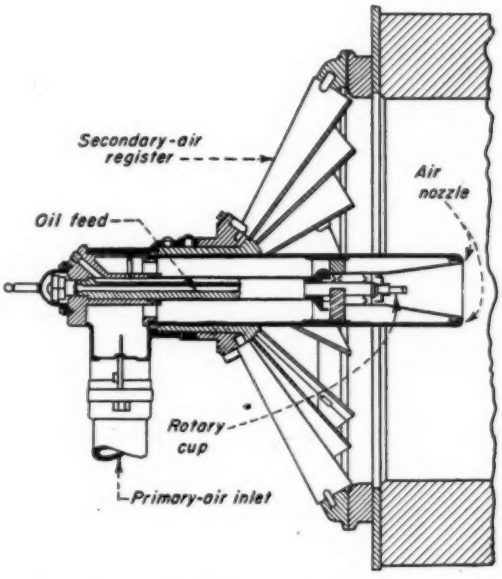


Fig. 4—In horizontal rotary-cup burner, oil is atomized by centrifugal action in a cup spinning at high speed. An air turbine rotates the cup in this design; in others, cup is driven by an electric motor

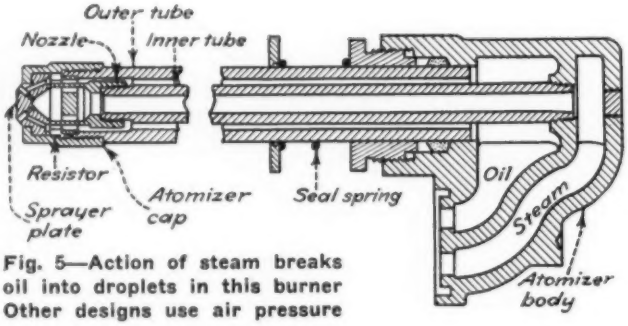


Fig. 5—Action of steam breaks oil into droplets in this burner Other designs use air pressure

particles and air so the vapor "coats" are stripped off as fast as they form and fresh surfaces are exposed. This calls for *penetration* of the oil droplets in the proper direction, and a high degree of *turbulence* of the air. Such relative motion of oil and air also helps produce more uniform mixture conditions over the combustion zone.

Combustion. With efficient atomization and vaporization, the actual combustion process for an oil fuel is much the same as for any gaseous hydrocarbon. The process is not, unfortunately, as simple as might be thought from the fact that we start essentially with hydrogen and carbon, and finish, if all goes well, with water and carbon dioxide, the traditional products resulting from burning hydrogen and carbon. Many practical observations and experimental facts now make it clear that hydrocarbon compounds do not burn by the direct combustion of either hydrogen or carbon.

In fact, there are two kinds of hydrocarbon combustion, and understanding both is essential because whether smoke is formed depends on which path the burning follows. Put simply, in what may be called "blue-flame" or "hydroxylation" burning, the hydrocarbon molecules take on oxygen atoms to form *alcohols* or *peroxides*, which split up into *aldehydes* (such as formaldehyde) and water. The aldehydes "burn" or decompose into CO_2 and H_2O as the final stage of the process. In what may be called "yellow-flame" or "carbonic" burning, the hydrocarbons decompose or "crack" into lighter compounds or completely to carbon and hydrogen. The latter then burn to CO_2 H_2O. Note that only in the carbonic process does uncombined carbon appear as a phase in burning gas or oil with the consequent possibility of forming soot or smoke.

For a clearer picture of these two combustion processes and the conditions that produce them. let's look at a simplified example. Fig. 6 shows methane burning in an atmosphere of air, and air "burning" in an atmosphere of methane. The former gives a yellow flame while the latter yields a blue flame. With the yellow, incomplete combustion produces soot, while with the blue, incomplete combustion produces invisible acrid vapors containing aldehydes. Why these differences?

In both cases, the flame center is exposed to strong heat radiation. In the first, methane cracks or decomposes before reaching oxygen, liberating carbon particles. In passage through the flame zone the carbon glows to incandescence giving the flame its yellow color. If anything stops this phase of the combustion process, such as contact with a relatively "cold" surface (the lamp walls, for example), soot forms.

In the second case, the strongly heated flame center is air, which can't decompose, while the methane on the outside of the flame is only mildly heated, so it does not crack. Strong preheating of air before contact with methane encourages the taking on of oxygen atoms characteristic of hydroxylation.

In actual practice, both general types of combustion occur in the usual flame so it is possible to speak only of its predominant characteristic. Referring to oil flames, Romp* sums up thus:

If conditions are favorable to primary oxidation. such as may be brought about by: (1) giving oil time and opportunity for complete, previous evaporation (2) thoroughly mixing air and oil vapor before combustion (3) suitably preheating the air or the mixture to favor formation of oxygen compounds, and (4) exposing the mixture to radiant heat gradually, if at all, then the oil will, for the greater part, burn by hydroxylation, resulting in a pre-

Oil Burning by H A Romp.

TWO TYPES OF HYDROCARBON COMBUSTION

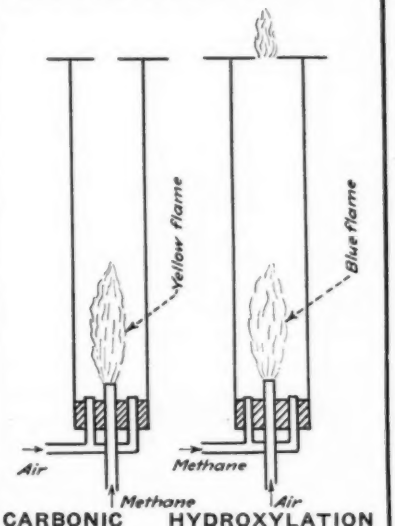


Fig. 6—When methane burns in air, gas cracks and glowing carbon makes yellow flame. If air burns in methane, no carbon is formed and blue flame results

dominantly blue flame without any tendency to soot but liable to produce acrid flue gases if incomplete combustion occurs.

Sometimes conditions are more favorable to thermal destruction, such as may be brought about by: (1) suddenly exposing the oil to intensive heat without giving it time and opportunity for previous evaporation (2) badly mixing oil and air (3) omitting preheating of air or mixture, and (4) exposing the mixture of combustibles suddenly to radiant heat. Then burning will mainly follow the carbonic process, resulting in a yellow flame with a strong tendency to soot, and producing flue gas with a fatty smell typical of oil soot.

Pollution Sources. With gas and oil fuels, this tendency to cracking and carbonic combustion forms the major pollution source. Traces of aldehydes in flue gas, resulting from incomplete blue-flame combustion, do not normally cause trouble nor does the relatively small amount of solid impurities (ash) met with in oil and gas fuels.

Thus the key to "smokeless" combustion of gas and oil fuels lies in: (1) encouraging hydroxylation and discouraging cracking, and (2) to the extent that cracking can't be avoided, making sure that the carbon formed gets a chance to burn completely without forming soot and smoke. Let's see what this means in terms of equipment, installation and operation.

Firing Gas. Starting with a fuel already in the gaseous state simplifies matters considerably and the design of most gas burners is such that combustion normally follows the hydroxylation path. This comes about because thorough mixture of fuel and oxygen occurs extremely early in the process, making it easy for oxygen atoms to find their way into the hydrocarbon molecules. In fact, most burners are the premix type, Fig. 2, in which part or all primary air is mixed with the gas before entering the combustion zone.

Premix burners differ in the pressure at which they operate and in the size of the port or opening from which the mixture burns. Atmospheric burners use gas at low pressure and induce the primary air from the atmosphere. These burners produce small blue flames. In larger furnaces, where flame may be longer and higher rates of heat release are desired, air may be induced by fans or blowers, or higher gas pressure employed. Burner of Fig. 2 exemplifies the large-port type; here passage of high-pressure gas through two venturi sections in series provides thorough mixing of gas and air in a short distance and maintains a more constant gas-air ratio.

Gas and air of the burner in Fig. 1 mix immediately outside the burner proper, but the design produces exceedingly thorough and turbulent combination in an extremely short distance. Gas under pressure issues at an angle from jets in the rotating spider; reaction causes the spider to spin. This drives the fan behind the spider, drawing in air. Interaction of gas jets and air results in quick mixing.

Firing Oil. Because oil firing requires fuel vaporizing for successful combustion it presents additional problems. The oil must be thoroughly atomized and the particles brought into *intimate* and *early* contact with air. The process starts in the burner and reaches completion in the combustion space. Thus conditions in both must be correct.

The burner's basic job is to break the oil into small particles and to so introduce them into the combustion space as to promote rapid and thorough mixing with air. The burner also supplies and regulates the primary air. In certain cases, additional, or secondary, air is introduced through furnace walls or floor. How well the burner carries out its job depends on: (1) burner design and condition, and (2) the physical condition of the oil as it reaches the burner, particularly its suitability for the burner's atomizing method.

Commercial and industrial burners differ principally in the method of obtaining atomization. Three basic types are shown in Fig. 3-5. In the general type of Fig. 5, a high-velocity fluid breaks the oil into small particles. The burner shown uses steam; other designs employ high- or low-pressure air. These fall into two broad classes depending on whether oil and the atomizing fluid mix inside the burner or outside. High-pressure burners, using either steam or air, can handle extremely heavy fuels such as refinery wastes and tars. A source of compressed air is required for high-pressure air-atomizing burners; low-pressure designs, operating at air pressures up to a few psi, use blowers.

Mechanical means effect atomization in rotary-cup burners, which consist essentially of an oil cup, driven by a motor or air turbine, and a surrounding air nozzle or ring. The cup, spinning at speeds from about 3500 rpm to as much as 7000 or 10,000 rpm, tears the oil into droplets by centrifugal action. Shape of cup determines to a certain extent shape of flame, a cylindrical bore tending to produce a fire with little taper while a cone-shaped cup yields considerably more taper. The air nozzle regulates action of the primary air and affects fire shape; it also determines the closeness of the fire to the cup.

Steam- or air-atomizing and rotary-cup burners have a number of points in common. In both, oil pressure is relatively unimportant; it is only necessary that pumps be able to deliver it against the resistance of the piping system. In general, adjusting the oil flow regulates firing rate in both types without affecting quality of atomization.

The third basic burner type atomizes oil mechanically as does the rotary-cup burner. Atomization method depends, however, on entirely different principles. In such units, commonly called "mechanical-atomizing" burners, oil is forced at relatively high pressure (75 to 200 psi or higher) through some form of slotted disk, which imparts a whirling motion, and then through a drilled hole in the nozzle, which completes atomization. All combustion air comes through the air register, which is always a part of the burner installation.

Since atomization depends on oil pressure, for a given nozzle size, permissible variation in oil pressure limits

firing-rate variation. Wider control range may be obtained by changing the nozzle tip or using multiple burners that can be turned on and off. Another method for securing wider range involves provision for opening additional holes in the nozzle. Recently developed wide-range designs have a primary pump supplying a constant oil flow to the burner line where a special valve or pump (the "differential" pump) changes oil pressure to atomize more or less oil through the tips while the balance keeps circulating.

Proper Condition of Oil. To do its job well the burner must receive fuel oil that is uniformly free of clogging impurities and of the proper viscosity. This requires care at every stage of the handling from storage tanks to burner. First step is to avoid accumulation of sludge and sediment in the tanks.

Mixing of oils of different character, such as occurs when deliveries from two sources go into the same tank, is a potential source of sludge trouble. Space does not permit detailing the reasons why certain hydrocarbons act as "peptizers" and tend to encourage dispersion or colloidal suspension while others are "coagulants" and tend to encourage precipitation. These simple rules will avoid troubles when oils are mixed: (1) Straight-run residue can be mixed with any straight-run product, and cracked residue with straight-run residue; (2) cracked distillate can be added as a third constituent, but (3) cracked residue *cannot* be added to straight-run distillate.

Strainers must be installed and maintained in good working condition to protect against sludge formation and sediment in the oil when delivered.

Fuel-oil viscosity must be maintained at proper levels so it can be pumped through the system and the burner atomize it thoroughly. Oils burned in industrial furnaces usually require preheating, accomplished in two stages. A heater in the tank raises temperature enough to lower the viscosity to a point suitable for easy pumping. Final heating, to obtain viscosity needed for good atomization, is usually done in steam and electrical preheaters connected in series ahead of the burner.

How closely oil temperature, and hence viscosity at the burner, must be controlled depends on the atomizing method. For mechanical-atomizing burners, recommended viscosity is 150 ssu at 100 F. Temperature to produce this viscosity depends on the fuel oil used. The Navy rule is 125 F plus the saybolt furol viscosity at 122 F. Fig. 7 shows viscosity-temperature relation for bunker C oil. Rotary-cup burners handle oils of viscosities up to 300 ssu while steam- or air-atomizing burners permit an even wider range.

Combustion Chambers. Because the furnace takes over where the burner leaves off. in providing the conditions necessary for completing combustion, it is equally important to smokeless operation. Within the flame, fuel must be vaporized, mixed with air and the resulting reactions between fuel and oxygen carried to a finish. Time is the most important factor, and since the reactions take place in travel from burner to furnace outlet, time is equivalent to distance.

Thus combustion-chamber length and shape must be carefully matched to flame length and shape. A good combustion chamber "hugs" the flame with a minimum of dead areas. On the other hand, the flame should not impinge on either furnace walls or boiler tubes. Impingement on refractory causes high maintenance and may cause smoke if "carbon mushrooms" form during starting when walls are cold. Impingement on boiler or waterwall tubes chills the flame, stopping reaction between uncombined carbon and oxygen to form soot and smoke.

Operation and Maintenance. Modern oil burners in proper combustion chambers should operate without smoke. If they do not, either operation or maintenance is at fault. Here are some things to watch:

Make sure the burner gets uniformly free-flowing oil, free of sediment that clogs burner nozzles. This means avoiding sediment build-up in storage tanks and keeping strainers in good condition. Preheat temperature must be right for fuel and burner, and must be uniform.

Keep burners in good condition by watching for wear caused by abrasion of ash in the fuel and for carbon build-up. In rotary-cup burners worn rims cause poor atomization. If cups are not properly protected after being turned off, carbon forms on the rim. When burner is shut down always take out the cup and insert a flame shield. Worn or carbonized mechanical-atomizing nozzles play hob with good combustion; replace worn nozzles and keep them clean.

Many smoke troubles arise from faulty air supply. If installation is manually controlled, make sure that air supply is regulated when oil flow is changed. Keep air inlet and fan blades clean. Clogging dirt and lint gradually cut air flow; smoke may result.

Smoke may be produced during starting, since the furnace is cold and conditions are unfavorable for complete combustion. If steam for preheating is not available during start-up, use a light oil until the furnace is hot and preheating can be done. Always start with a moderate flame, shifting to high flame when the furnace has warmed sufficiently. *Avoid overloads.* If multiple burners are installed for varying load, be sure that any burner taken out of service is removed from the furnace to avoid carbon build-up. Watch out for "dribbling" when burners are shut down; if burner dribbles, check valves.

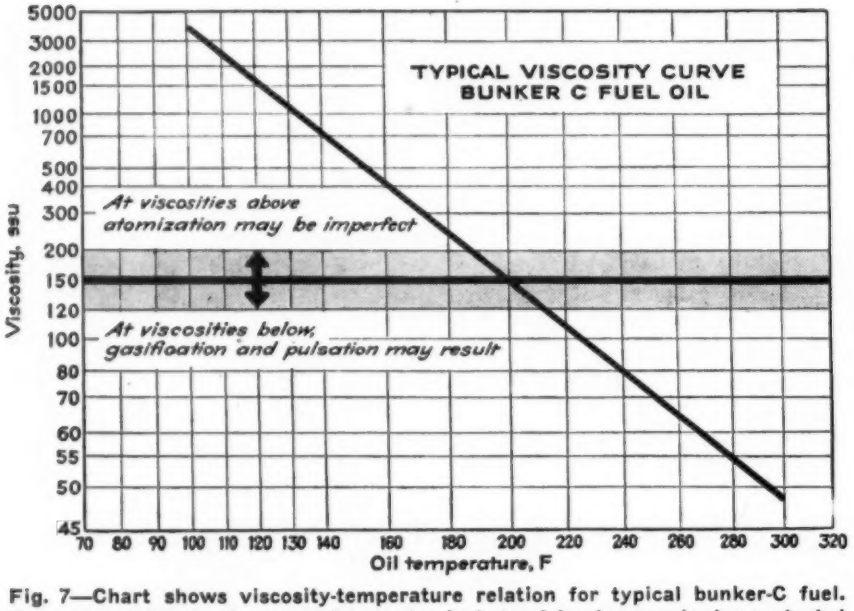
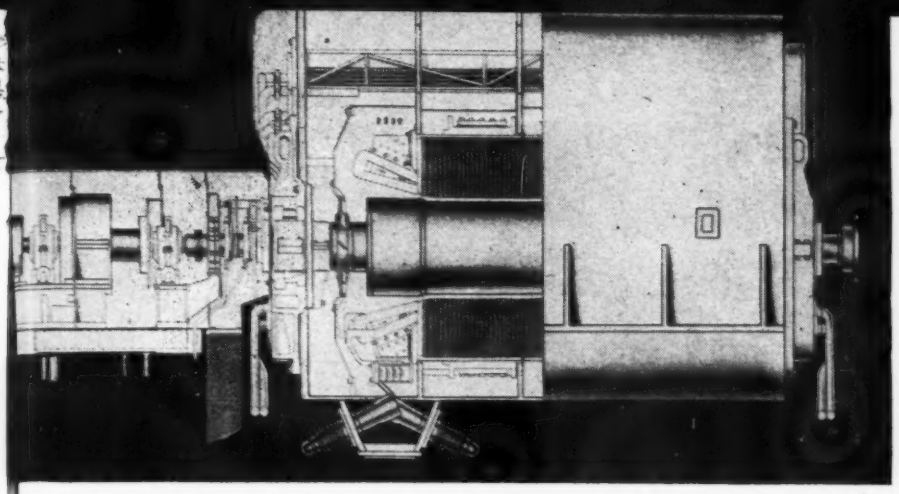


Fig. 7—Chart shows viscosity-temperature relation for typical bunker-C fuel. Recommended operating range for mechanical-atomizing burners is shown shaded



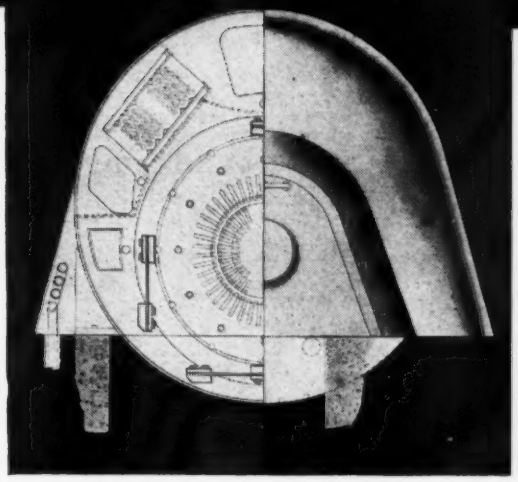


Fig. 1—Longitudinal cross section of large two-pole 3600-rpm hydrogen-cooled ac generator showing exciter and hydrogen-cooling tubes. Fig. 2—Axial section of same generator showing the flexible stator-core mountings

Large Generators Prove Themselves

During the past decade the two-pole generator for large ratings has been demonstrated as thoroughly adequate. Lighter parts facilitate manufacturing, installation and maintenance

By C M LAFFOON, MANAGER
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▶ THE POWER-GENERATING INDUSTRY, hastening to keep pace with rapidly rising requirements for energy, finds its only serious generator problem growing out of the fact that so many are needed at once. Large ac generators of proven dependability in all sizes are available—including the largest needed and standard units that simplify the problem of buying, lower the cost and shorten the period between purchase and power delivery.

High-Speed Units. During the past decade the two-pole generator for large ratings has been demonstrated thoroughly as adequate. Its efficiency, reliability and suitability for operating conditions compare favorably with units for 1800 rpm. The smaller and lighter rotating parts of the 3600-rpm turbine and generator greatly facilitate manufacturing, installation and maintenance operations. At present, single-shaft, 3600-rpm generators for ratings up to and including 80,000 kw or 100,000 kva at 0.8 pf, and 90,000 kw, 105,800 kva at 0.85 pf. are being built. A small number of 1800-rpm units are being built for 75,000 kw and higher at 0.8 to 0.9 pf.

Before the two-pole generator could be built in the large central-station sizes, solutions had to be found for certain problems inherent in the two-pole machine in addition to those resulting from higher speed. Double-frequency vibration caused by unequal rotor rigidity on its two major axes has been eliminated without introducing rotor magnetic saturation. Uniform rigidity in the plane of the poles, and at right angles to them, is obtained by transverse slots machined into the pole faces. Double-frequency vibration of the stator core is kept within tolerable limits by using rigid cores, the laminations being tightly clamped together so that the built-up body functions as a solid cylinder.

Transmission of vibrations from the stator core to the housing, foundations and station has been reduced to a negligible magnitude by flexibly supporting the stator core relative to the frame housing, Fig. 2 and 3. Some noise is transmitted from the stator core through the intervening air to the stator housing. Noise level of a 3600-rpm unit is somewhat higher than that of an 1800-rpm unit, but well within acceptable limits.

Hydrogen Cooling. Hydrogen now generally cools all two- and four-pole turbine generators rated at 20,000 kva and over. Oil-treating equipment removes moisture and other entrapped gases from the oil supplied to the hydrogen-sealing glands, Fig. 5. Hydrogen consumption for units operating at 0.5 psig pressure has been well below maximum expected value of 100 cu ft per day. Since oil-treating equipment represents an appreciable investment, its elimination for lower ratings becomes attractive. Consideration is being given to developing sealing glands and operating methods that will make it possible to dispense with oil-treating apparatus for small machines. If conservative clearances are provided and a reasonable amount of oil is passed through the seals, it is expected that the increased consumption of hydrogen will not be excessive.

Turbine-generator ratings assume a hydrogen pressure of 0.5 psig. For the past several years, Westinghouse units have been made for operation up to 15 psig with an attendant 15% rating increase. Several years satisfactory operation with the higher gas pressure has been obtained with reasonable hydrogen consumption. This record suggests the future need to consider fixing nominal ratings on the basis of a higher gas pressure.

Standard Generators. The new AIEE-ASME jointly sponsored standards for 3600-rpm central-station turbine generators have been available for more than a year. These are limited to ratings, characteristics and perform-

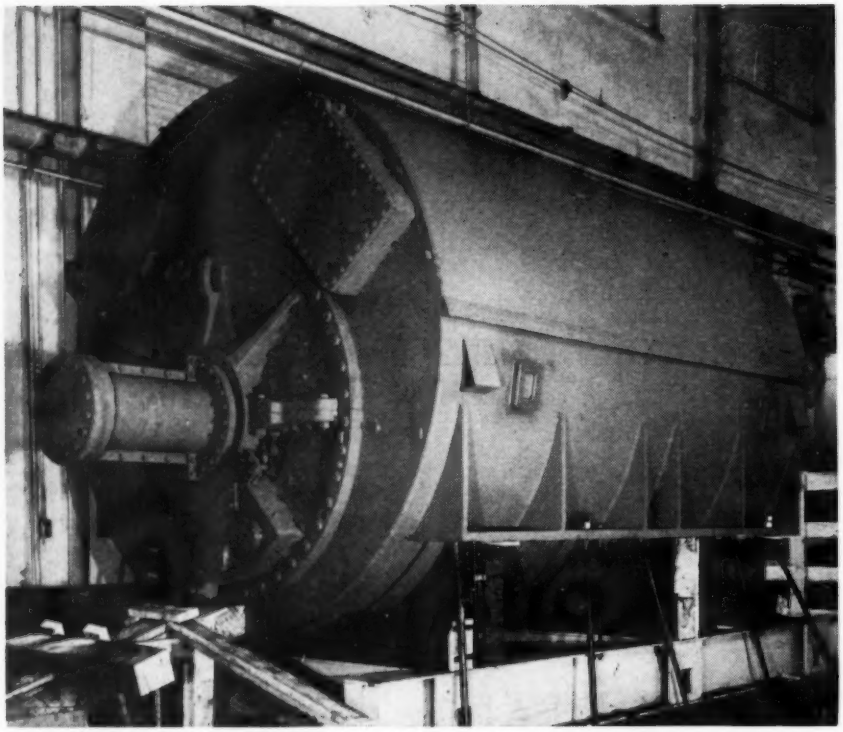


Fig. 3—This is a completely assembled hydrogen-cooled generator mounted on a railway car ready for shipment. Entire unit with rotor ready for hooking-up

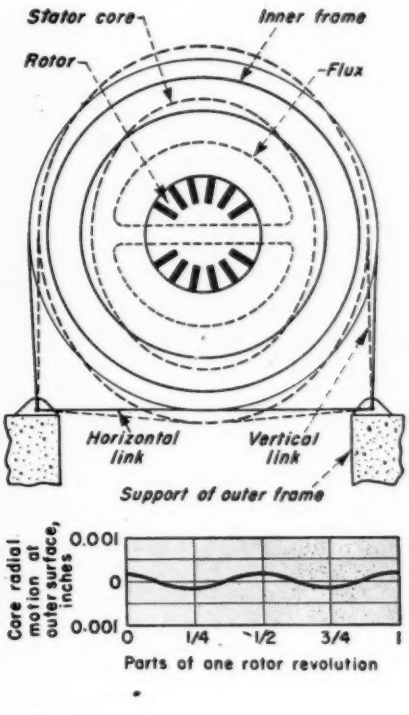


Fig. 4—Here's how flexible mountings dampen the stator-core's vibrations

ance. Nominal ratings are based on using the gas cooling medium at atmospheric pressure or slightly above for hydrogen-cooled units. Generator rating increase of 15% has been given for operation of 15 psig hydrogen pressure, Table 1.

Designs and manufacturing tools for all standard generators are complete, excepting the two smaller sizes which are expected to be added this year. Supplementing the AIEE-ASME standardization for these ratings, additional standards covering primary construction features, location and arrangement of gas coolers, type and location of main-lead terminals, terminal boards for temperature-indicating devices, auxiliary equipment for treating gland-sealing oil and gas-drying and hydrogen-control equipment have been made by each manufacturer.

Advantages of overall standardization by industry and manufacturers have exceeded early expectations. Directly, it has made possible lower prices, shorter manufacturing time and a better machine. It has also expedited design of the generating station.

The new standard line makes it possible for the manufacturer to stock primary elements and auxiliary equipment purchased from outside suppliers in anticipation of actual orders. Acceptance of the new standard line has prevented the development of a serious bottleneck in design engineering today with the large volume of construction under way.

It would be helpful if unified manufacturing standards were to be adopted for additional items not now covered. Meanwhile manufacturer and purchaser can cooperate so that by end of 1947 most of the turbine-generator units within standard-rating range will conform to the standards.

Large Standard Machines

When the new standards were being formulated, a group of utilities, normally needing generators above 60,000 kw, believed larger machines should be designed for lower power factor and higher short-circuit ratio. Twelve 3600-rpm generators rated at 65,000 kw, 81,250 kva, 0.8 pf, 0.9 short-circuit ratio (or equivalent rating) are now in operation or construction. Several 3600-rpm generators for ratings of 80,000 and 90,000 kw, 0.8 and 0.9 pf for 0.9 and 0.85 short-circuit ratio, respectively, are now being built. As a result, 3600-rpm generators above 60,000 kw are being projected and developed as needed, Table 2.

Although several 1800-rpm units of 75,000, 80,000 and 100,000 kw and above are being built, it is expected in the future most units up to and including 100,000 kw will be high-speed machines. In these large high-speed machines it is necessary to (1) use highest quality forgings for rotor and retaining rings (2) provide most effective ventilation for rotor winding (3) have a coordinated rotor design to withstand continuous and alternative forces and stresses imposed on the component parts by rotation and thermal cycling (4) increase power factor (5) reduce short-circuit ratio, and (6) increase hydrogen pressure.

For large machines gas pressures up to 25 and 30 psig are being considered. About 1% increase in rating can be obtained for each one psi increase in hydrogen pressure up 25 psig total, after which the rate of increase tapers off. Nominal rating has been based on 0.5-psig hydrogen pressure and an increase in rating specified if higher gas pressures are used. Since stator and rotor windings and stator core respond differently to ventilation at higher gas pressures the actual temperature conditions are somewhat unbalanced. For the largest ratings, it is proposed to design the unit for maximum rating at highest practical pressure and then specify the ratings for the lower gas pressure.

A generator designed for 25- or 30-psig gas pressure is more costly than one for 15 psig. Stator housing needs

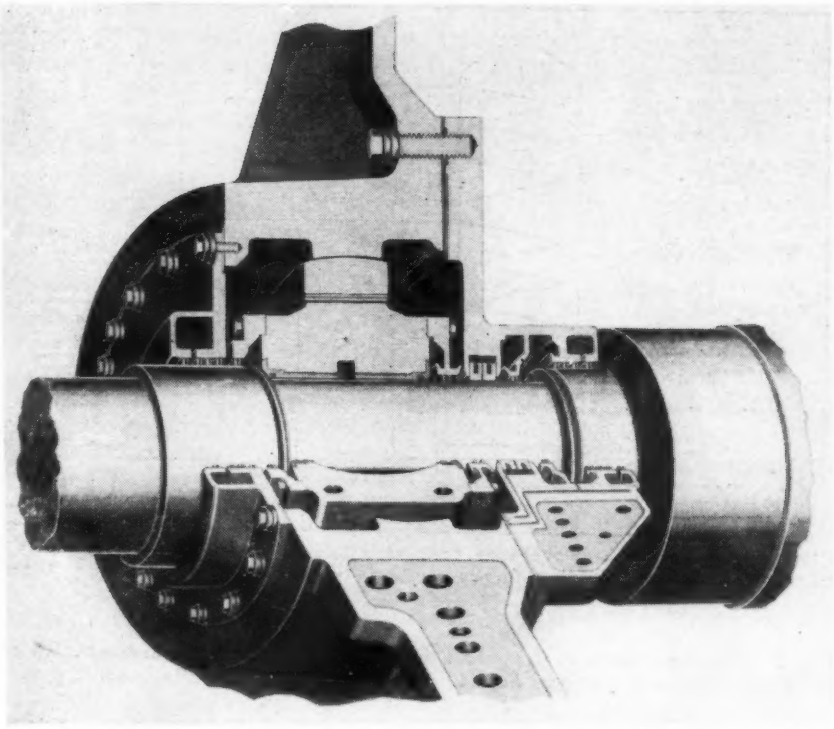


Fig. 5—Perspective quarter-section of a main bearing of hydrogen-cooled ac generator shows hydrogen-sealing glands on the inboard and outboard sides

Most Westinghouse 3600-rpm generators in service and under construction have direct-coupled 3600-rpm main and pilot exciters. A few units are being built without direct-connected exciters, but will use either 1200-rpm motor-driven exciter sets or electronic excitation. One electronic-excitation system installed at the Springdale Station, West Penn Power Co, performs satisfactorily. Three units are being built with electronic-excitation systems where the power to the electronic equipment will be supplied by direct-driven 6-phase auxiliary generators. While acceptable reliability and availability of electronic systems is anticipated, the facility with which direct-connected-exciters can be serviced may go a long way to retain operator approval of a known and tried excitation means. Initial cost of the electronic-excitation system is much higher than that of the direct-coupled or the motor-generator exciter. Performance of the electronic systems will be watched with considerable interest by the central-station industry.

thicker walls and heavier welds. Joints between (1) end bracket halves (2) end brackets and cylindrical housing sheet need much heavier flanges with larger and higher-strength bolts. Increased oil flow to sealing glands requires more oil-treating capacity. Some increase in gas consumption is anticipated.

Projected ratings and characteristics for 3600-rpm units with ratings above 100,000 kw are shown in Table 3. For these units it is expected that shaft-mounted high-pressure propeller-type blowers will be used to circulate the hydrogen. Design will allow same factor of safety for stress loadings, vibration, efficiency, reliability and thermal margin as for smaller units.

Because of current-carrying limitation of the main-lead terminals, it is recommended that the most economical voltage be used for each rating. This would be the voltage normally resulting from the use of single-turn half-coils and the winding Y-connected in two parallel or two winding circuits. Most economical potential falls between 13,800 and 18,000 volts, terminal to terminal. To reduce excitation-current magnitude handled by collector rings and exciter, the excitation voltage should be 375 to 500 volts. Two 81,250-kva 3600-rpm generators are now being built for a 375-v excitation system.

Table 1—Ratings of Present Standard 3600-Rpm Turbine Generators With Hydrogen At Low and High Pressures

Unit size	Rating at 0.5-psig hydrogen pressure				Capability at 15-psig hydrogen pressure				Number units on order[2]
	Kw	Kva	Pf	Scr[1]	Kw	Kva	Pf	Scr[1]	
1[4]	11,500	12,940	0.85	0.8					1
2	15,000	17,650	0.85	0.8					0
3	20,000	23,500	0.85	0.8	22,000	25,900	0.83	0.8	5
4	30,000	35,300	0.85	0.8	33,000	38,850	0.83	0.7	13
5	40,000	47,100	0.85	0.8	44,000	51,800	0.83	0.7	9
6	60,000	70,600	0.85	0.8	66,000	77,600	0.83	0.7	17

Table 2—Ratings of 3600-Rpm Turbine Generators Under Construction Larger Than Present Standard

Unit size	Rating at 0.5-psig hydrogen pressure				Capability at 15-psig hydrogen pressure				Number units sold
	Kw	Kva	Pf	Scr	Kw	Kva	Pf	Scr	
7	65,000	81,250	0.80	0.9	81,250	93,500	0.87	0.78	3
8	80,000	100,000	0.80	0.9	100,000	115,000	0.87	0.78	5[5]
9	100,000	125,000	0.80	0.9	125,000	143,750	0.87	0.78	0

Table 3—Ratings of Proposed Very Large High-Speed Generators at Three Gas Pressures

Unit size	Capability at 0.5-psig hydrogen pressure				Capability at 15-psig hydrogen pressure				Rating at 25-psig hydrogen pressure			
	Kw	Kva	Pf	Scr	Kw	Kva	Pf	Scr	Kw	Kva	Pf	Scr
10	91,250	107,000	0.85	1.0	116,500	137,000	0.85	0.85	125,000	147,000	0.85	0.8
11	109,500	129,000	0.85	1.0	140,000	165,000	0.85	0.85	150,000	176,500	0.85	0.8

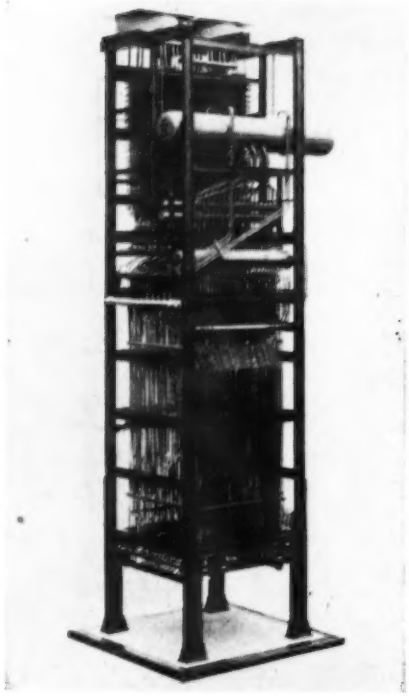
[1] Short-circuit ratio

[2] Some units do not have standard ratings

[3] As of March 1, 1947

[4] Air-cooled only

[5] Includes two generators at equivalent ratings for different pf and Scr



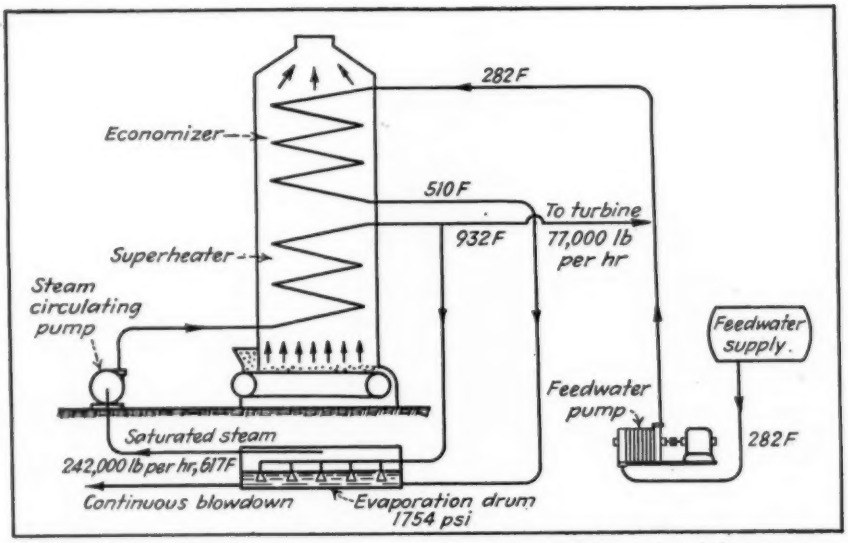


Fig. 1—The Loffler high-pressure generator has no tubes containing concentrated water exposed to the furnace. Evaporation takes place in outer drum

Fig. 2—left—The Schmidt-Hartmann uses a 2-cycle design. Steam goes to an evaporator where it gives up heat to generate steam at slightly lower pressure

Survey of German Feedwater Practice

After inspecting power plants the War Utilities Subcommittee reports interesting developments that include corrosion prevention by ammonia in condensate, nitrogen in idle boilers*

By W W CERNA *Hall Laboratories, Inc.*

▶ GERMAN SUPPLIES of raw water, both well and river, are in general decidedly hard. Moreover, most of the rivers are highly contaminated with industrial waste.

Where clarification is necessary engineers use settling basins and flocculation with sulphates of aluminum, or iron, or iron chloride, followed by filtration. A pH range of 6 to 7 is recommended with aluminum salts. With iron salts, best floc formation is claimed for a pH range of 5 to 6, and satisfactory results are also reported in a range of 8 to 9.

On water heavily contaminated with industrial and organic wastes, good outcome is claimed by first chlorinating the water to a residual of 0.2 ppm, followed by a 3-hour settling period and filtration.

Oil removal from cold condensate is accomplished by adsorption on precipitated metallic hydroxides, obtained by the use of aluminum or iron salts. For hot condensate, activated carbon filters reduce the oil content from 5 to about 0.5 ppm.

Precipitators. These are the ordinary type and are fairly simple in design. Both cold- and hot-process lime-soda, or caustic soda and carbonate, softeners are used for the reduction of bicarbonate and sulphate hardness. Long settling periods characterize operation, two hours being the common retention time for hot-process units. In general, considerable excess of treating chemicals is used.

Hot-process phosphate softeners are characterized by use of rather high excess chemicals, to obtain treated water of very low residual hardness.

Cation and Anion Exchangers. Of particular interest is the *Wofatit* group of synthetic exchange resins. One of these, the *Wofatit P*, has been used at temperatures as high as 210-212 F, following hot-process precipitators. It is a particularly hard (physically) resin of the aromatic sulphonic acid group. Precautions claimed necessary for satisfactory service on hot-water softening are: (1) The water must first be completely deaerated. (2) A maximum pH value of 8.5 should not be exceeded. As preliminary hot-process softening and silica-reducing treatments in Germany usually produce an effluent of pH 9.5 or more, with some residual oxygen present, it is customary to feed sulphur dioxide, after the filters, for both pH reduction and oxygen removal.

It is common to use the phenolphthalein alkalinity of water as a control guide because the test is simple compared to accurate pH determinations. For example, at one plant, the phenolphthalein alkalinity of the filtered effluent from the preliminary

* Abstract of a paper presented at the seventh annual water conference of the Engineers' Society of Western Pennsylvania, Jan. 7, 1947.

hardness- and silica-reduction plant was about 0.5 ml N/10 acid per 100 ml of water. This was reduced to 0.05 ml maximum, with sulphur dioxide (average requirement about 8 ppm SO_2) before the water entered the *Wofatit P* exchanger.

For regeneration, a 6.4% sodium-chloride solution is used at a temperature of 200-205 F. To save water, one plant collected clear boiler blowdown at about 200 F and used it for rinsing the softeners after regeneration. The alkaline boiler water produces no ill effects on the exchange material. Regeneration is scheduled when the residual total hardness of the effluent exceeds 0.5 ppm as equivalent $CaCO_3$.

While anion exchangers were not found in German power plants, one such unit, *Wofatit M*, can be used at temperatures approaching 212 F. *Wofatit M* is produced from an aliphatic amino group of resins.

In the newer plants, final softening with base exchange softeners in either hot or cold systems is practically universal. For the high-pressure plants, base exchange softeners often operate in series to assure maximum hardness removal. Regeneration of the second and final series softener is infrequent because the entering water is low in hardness.

Silica Reduction. German feedwater-conditioning consultants generally accept about 7-ppm silica as the maximum amount tolerated in high-pressure boilers (some place the limiting value at 4.5 ppm) without certainty of encountering turbine deposits. Silica deposits in turbines are reported mainly in the temperature range of 500 to 535 F, with some as low as 185 F. Actually, German engineers have been rather oversold on the high solubility of silica and boiler-water salts in steam.

As a result, excessive chemical treatment is frequently used, resulting in high treating costs and blowdown, whereas greater emphasis on better mechanical separation of steam from water in boiler drums would often be advisable. Examples are found in the Loffler boilers at the Leverkusen and Hochst plants of I G Farben. Design of the steam-generating drum is such that it almost seems intended to promote carry-over. At the Hochst plant, Fig. 4, a large amount of sulphur dioxide was added to the highly alkaline-treated water. This practice increases treating costs and blowdown, and reduces rather than eliminates turbine deposits.

German silica-removal systems fall

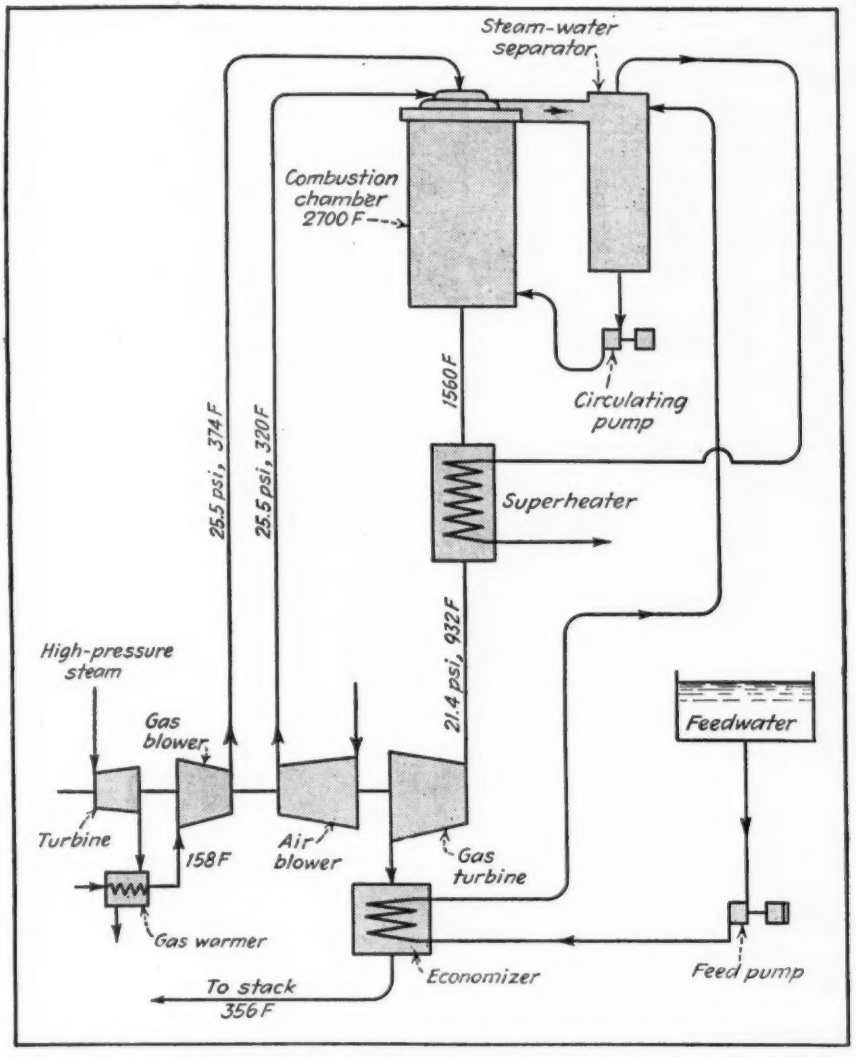


Fig. 3—In a combination Velox boiler and gas turbine the combustion chamber is fired under a pressure of 25 psi. Turbine exhaust gas heats the feedwater

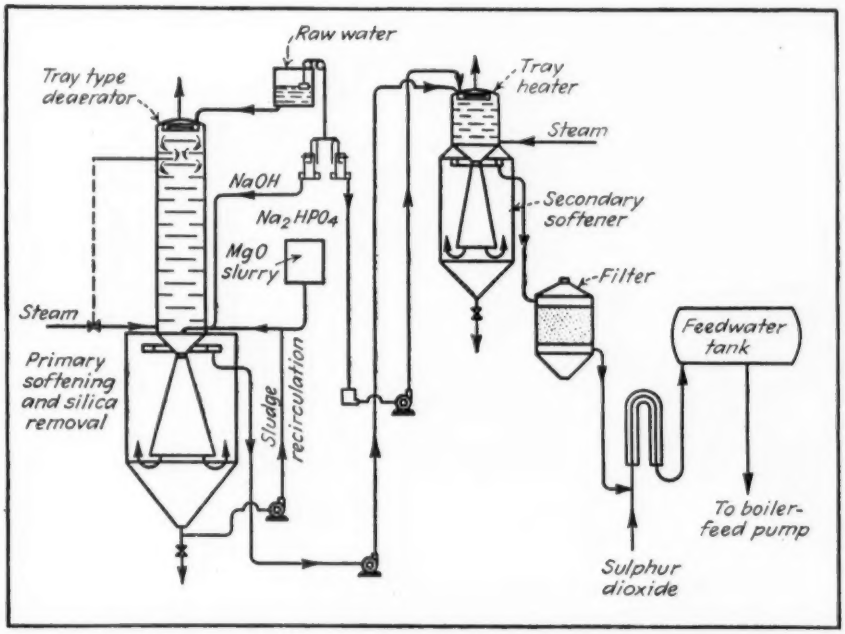


Fig. 4—Multistage precipitation softening and silica-removal system used at the Hochst plant of I G Farben gave good results with 25 to 30 ppm MgO feed

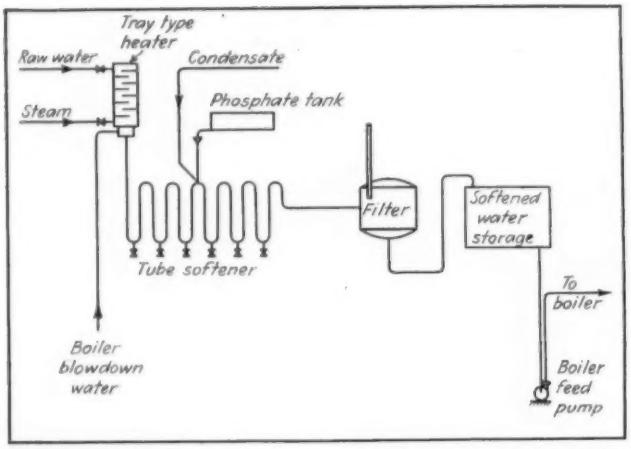


Fig. 5—In the tube softener, reaction occurs during water passage through a series of coils on its way to a filter

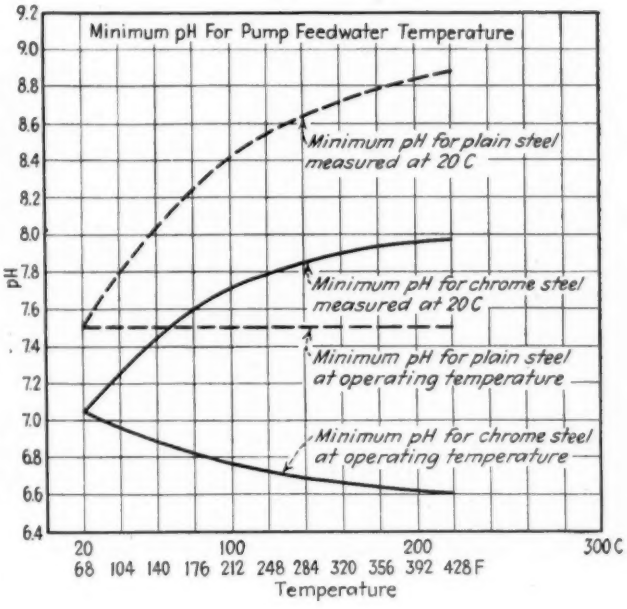

Minimum pH For Pump Feedwater Temperature
pH
Minimum pH for plain steel measured at 20 C
Minimum pH for chrome steel measured at 20 C
Minimum pH for plain steel at operating temperature
Minimum pH for chrome steel at operating temperature
20 100 200 300 C
68 104 140 176 212 248 284 320 356 392 428 F
Temperature

Fig. 6—Curves show lowest feedwater pH to maintain, depending on water temperature and impeller composition

into two main classes, as follows:

1. *Cold-process treatment.* Low residual silica (average less than 1 ppm SiO_2 in effluent) is obtained with equimolecular quantities of sodium aluminate and magnesium chloride. Large amounts of chemicals are used. For example, at the Wolfen plant of I G Farben, the chemical feed consists of 150 ppm of sodium alumniate (containing 35% Al_2O_3) and 90 ppm magnesium chloride. In addition to high chemical costs, this treatment also increases blowdown requirements considerably because the treated effluent has its sodium chloride concentration increased by 110 ppm. Control is based on maintaining a pH of 8.3 to 8.7 in the filtered effluent. Two hours is retention time in the sludge-blanket reaction tank. Sludge is recirculated.

2. *Hot-process treatment.* This is similar to the usual American practice. Originally, Germany used very large quantities of magnesium oxide in sludge-type reaction chambers, to produce low residual silica. Because of difficulty in deliveries of chemicals during the latter part of the war, greater attention was paid to operating with minimum additions of fresh chemicals. At the Hochst plant of I G Farben, 200 to 400 ppm of magnesium oxide was used at first. Then sludge recirculation was instituted and good silica removal obtained with 60 to 80 ppm magnesium oxide. Finally, this was reduced to 25 to 30 ppm with increased sludge recirculation, and about the same degree of silica removal. Hot-process systems are operated at a high degree of alkalinity. For best results a pH range of 10.5 to 11.0 in the filtered effluent is considered necessary.

Filters. Lacking a thoroughly inert material such as anthracite coal, German filters are mainly of quartz, calcium carbonate, or partly burned dolomitic material. Certain types of quartz filters are claimed to be practically inert even to hot alkaline waters, such as obtain from hot-process softeners. Nevertheless, the new installations are usually the so-called *magno* filters, using partly burned dolomite, of the composition $MgO.CaCo_3$. This material gives no silica increase and is also, by preliminary preparation with sodium phosphate, apparently inert to hot phosphate-treated water.

Wirbos Softener. An interesting cold-process partial softening installation was inspected at the Fortuna station in the Cologne area, known as a *Wirbos* (rotary flow) granular or catalytic softener.

A conical, closed shell, it is about half-filled with granular precipitated calcium carbonate. For bicarbonate hardness reduction, water and milk

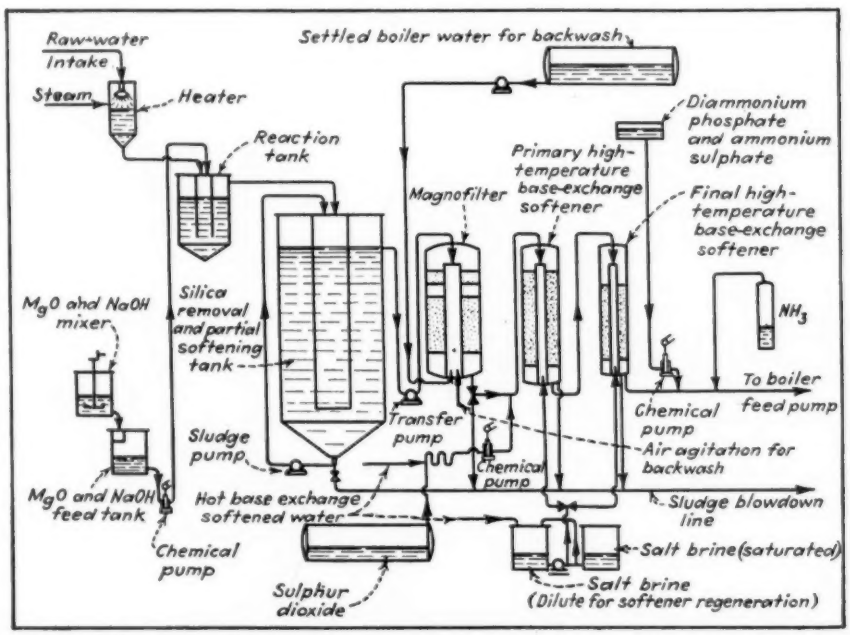


Fig. 7—Makeup treating system at the Huls synthetic-rubber plant includes high-temperature base-exchange softening, ammonium feed, silica removal

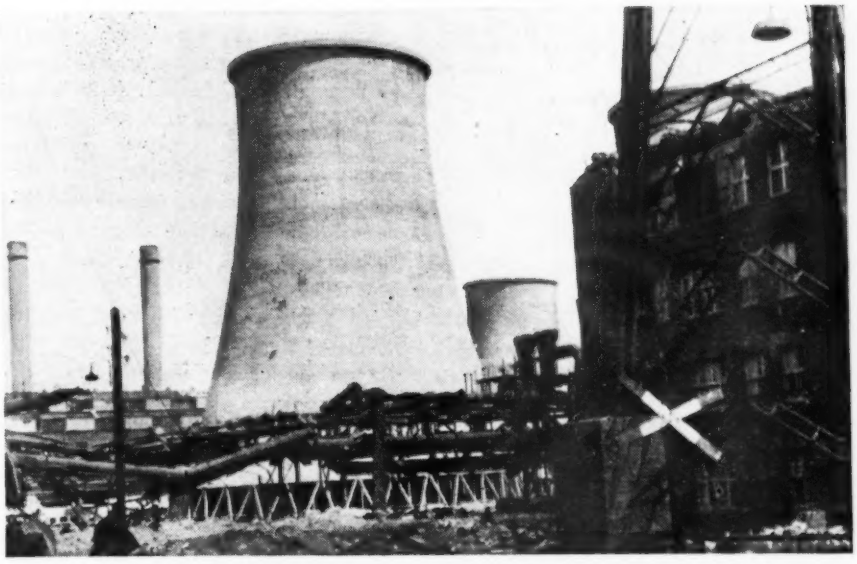


Fig. 8—Each cooling tower is made large enough to care for one turbine condenser. Capacity is based on 60 lb of cooling water per lb of steam condensed

of lime are introduced tangentially through separate lines entering the bottom of the cone, producing an upward rotary flow. Reaction products, calcium carbonate and magnesium hydroxide, crystallize on the calcium carbonate grains already present, the action akin to that of "seeding" supersaturated solutions with crystals to obtain precipitation. The reactions and separation are reported as completed within about five minutes. Effluent is passed through a standard filter.

As the original grains in the softener grow because of precipitated hardness, fastest growing grains are removed by opening a discharge valve at the bottom of the cone.

Effluent from the *Wirbos* softener is evidently well stabilized and at Fortuna is used for makeup to the condenser recirculating cooling-water system. Feedwater makeup is also obtained by passing the water through sodium base-exchange softeners for more complete hardness removal.

Tube Softener. There is a little enthusiasm in some water-conditioning circles over the possibilities of a tube-type water softener, Fig. 5.

The complete system includes a cascade preheater for deaeration at 212 F and carbonate hardness reduction, in the base of which boiler blowdown is added. The water then goes through several loops of tubes to permit reaction with the chemicals in the boiler water. Next, sodium phosphate is admitted and the water flows through the remaining loops for further softening. Effluent, together with the precipitated hardness, is passed to a filter for sludge removal.

Actually, the softener seems technically unsound, as insufficient reaction time exists in the tube. Also, under the necessary operating conditions, the tube would probably become badly plugged with precipitated material. The filters would be overworked because there is no preliminary sludge removal. Recognition of these factors has prevented widespread use of the system.

As is usually the case with such questionable apparatus, an installation at the Chemischen Fabrik Budenhein in Mainz claims great success. On the other hand, a plant at Weisbaden, Kalle & Co, placed a tube softener in operation in Sept, 1939. Within six weeks some of the 0.8-in. ID tubing, was found plugged to 0.2 in. Filter overloading, and high filter backwash requirements were also problems.

Deaeration. No new developments in mechanical deaeration were noted. In comparison, chemical deaeration involving sodium sulphite or sulphur dioxide is widely used.

Being a neutral salt, sodium sulphite is added to condensate feedwater systems. Because of its high alkali-neutralizing value, sulphur dioxide serves where alkali reduction is desirable. Fig. 4 and 6. Of interest is the use of sodium hyposulphite at the Mannheim plant.

For equivalent oxygen removal only two-thirds as much sodium sulphate is formed by using sodium hyposulphite. Maximum alkali reduction is obtained with sulphur dioxide, and zero alkali reduction with sodium sulphite. Also, for each ppm of oxygen removal, total increase in dissolved solids is about the same with either sulphur dioxide or sodium hyposulphite, and roughly half as great as with sodium sulphite, when sodium hydroxide neutralization is also considered.

USE OF AMMONIA

One of the most interesting German developments is the application of ammonia and ammonium salts to feedwater and boiler-water conditioning.

A number of American chemists have long considered ammonia for water conditioning. But because of its possible and likely corrosion of nonferrous parts its use has been considered unsafe. Thus, in America, emphasis has been on avoiding rather than introducing it.

For all-steel systems, ammonia and ammonium salts offer unquestioned advantages. They provide a ready means of maintaining desirably-high feedwater and condensate alkalinity, without increasing boiler-water alkalinity. The ammonia is evaporated and carried over with the steam, making it available in the condensate.

Dr Wesly did considerable experimental work on the subject and concluded that, in the absence of oxygen, ammonia concentrations up to a maximum of 10 ppm as NH_3 would not attack nonferrous metals, such as the 70% copper, 29% zinc and 1% tin used

TABLE I—METALS FOR HIGH-PRESSURE FEEDWATER PUMP PARTS AT TEMPERATURES OF 250–420 F

pH of feedwater*	Impellers	Casings	Balancing disks	Counter-balancing disks
Below 6	14–18% Cr	10% Cr	14–18% Cr	22% Cr
6–7	14–18% Cr	Steel**	14–18% Cr	22% Cr
7–8	14–18% Cr	Steel**	14–18% Cr	22% Cr
8–9	14–18% Cr	Steel**	14–18% Cr	22% Cr
Above 9	Steel**	Steel**	14–18% Cr	22% Cr

*pH measured at room temperature; ** Plain steel of 1.5% manganese.

for fabrication of condenser tubes.

For plants with brass-tube condensers, ammonia is not universally accepted in Germany and some excessive corrosion followed its use. In these cases, Dr Splittgerber maintained that ammonia was the corrosive agent, whereas Dr Wesly blamed oxygen.

Nevertheless, some plants obtained excellent results with no evidence of brass corrosion in the condensing systems. One example is the Huls synthetic-rubber plant, Fig. 7, which instituted the use of ammonia and ammonium salts in 1940. Originally, ammonia feed was relatively low, about 3 ppm NH_3 in the condensate, with pH values ranging from 8.0 to 8.5. As this did not fully eliminate steel corrosion and no deleterious effects appeared in the condensers, ammonia feed was increased in 1941 to produce about 10 ppm NH_3 in the condensate, with feedwater and condensate pH values in the range of 8.5 to 9.0. This increase eliminated corrosion in the steel system, and did not corrode the steam side of the brass condenser tubes.

Dissolved oxygen in condensate at the Huls plant was reported as zero, measured by the standard Winkler test. Based on its normal accuracy this test indicates that the dissolved oxygen content did not exceed 0.05 ppm.

In a repeat visit to the Huls plant on August 30, 1945, we learned that for about three months they operated without ammonia. After about one month, corrosion made it difficult to operate economizer and feedwater heat-exchanger valves. After ammonia feed was re-instituted, the troubles were reported eliminated.

The Huls plant feeds a solution containing 5 lb of ammonium phosphate per 75 lb of ammonium sulphate. Additional ammonia gas is fed to the feedwater system following the *Wofatit* base-exchange softeners to increase feedwater alkalinity, Fig. 7.

Internal Treatment. Nothing really new or different in boiler-water conditioning was found other than the use of ammonium salts for alkali reduction. Phosphate is universally used.

Boiler-water conditioning also includes alkali and total solids control, as well as the use of sulphur-reducing compounds to remove dissolved oxygen. As most of the modern plants include high-pressure boilers, considerable emphasis is placed on external preparation. Thus, with treated-makeup water systems, silica reduction and final softening to very low residual hardness, by either external phosphate or base-exchange softeners, were found practically without exception.

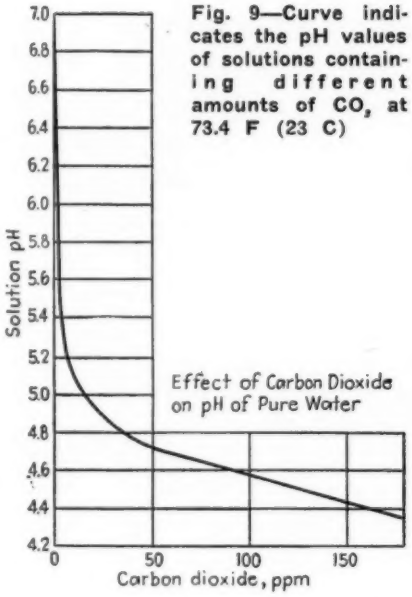


Fig. 9—Curve indicates the pH values of solutions containing different amounts of CO_2 at 73.4 F (23 C)

Other Protection. War demands left the Germans especially short on copper and nickel. Therefore, they used plain iron and steel materials as much as possible. During the latter part of the war galvanized steel tubes were even used for turbine condensers.

Engineers of Klein, Schanzlin and Becker, in Frankenthal, gave considerable attention to pump problems related to corrosion in high-temperature feedwater systems. They standardized on various metals for different pump parts, depending on the expected operating conditions, Table I. KSB issued a curve sheet, Fig. 6, as a guide in determining the lowest pH to maintain in the feedwater, depending on the water temperature and impeller metal composition.

NITROGEN FILLING

To prevent internal corrosion during standby periods, methods of wet and dry lay-up are similar to those in American practice. Commonest method for closed equipment is the use of nitrogen gas, maintained at slight pressure, to prevent inleakage of air.

At the Hochst plant the entire high-pressure system—boilers and turbines—was closed and kept under a slight pressure of nitrogen.

At one plant, Leunawerke in Saxony, gaseous ammonia was used for standby protection against corrosion of superheaters. While this protected the steel economizer tubes, corrosion resulted in the connected nickel-bronze valve seats and stems. Complete satisfaction was reported after the affected nonferrous parts were replaced with stainless steel ones.

Circulation of warm air through an idle turbine to avoid moisture condensation was also recommended, but actual plant experience was not encountered.

(*Continued on page* 158)

TABLE II—pH VALUES OF CHEMICAL SOLUTIONS AT TEMPERATURE OF 73 F (23 C)

ppm.	Sodium hydroxide $NaOH$	Sodium carbonate Na_2CO_3	Trisodium phosphate anhydrous Na_3PO_4	Trisodium phosphate crystalline $Na_3PO_4.10H_2O$	Ammonia NH_3
2	9.8	9.6	7.9	7.7	8.5
3	10.0	9.8	7.95	7.75	8.65
5	10.3	10.0	8.0	7.8	9.1
10	10.5	10.3	8.25	8.0	9.6
20	10.8	10.6	8.65	8.2	10.1
30	11.0	10.8	8.9	8.4	10.25
40	11.0	10.9	9.1	8.6	10.45
50	11.2	11.0	9.1	8.8	10.47
60	11.3	11.05	9.3	8.9	10.48
70	11.37	11.10	9.35	9.0	10.49
80	11.45	11.15	9.4	9.1	10.5
90	11.48	11.18	9.45	9.15	10.5
100	11.5	11.2	9.5	9.2	10.51
125	11.6	11.22	9.6	9.3	10.57
150	11.7	11.24	9.7	9.4	10.6
175	11.75	11.27	9.8	9.45	10.62
200	11.8	11.3	9.9	9.5	10.65
250	11.9	11.35	10.05	9.6	10.7
300	12.0	11.45	10.15	9.7	10.75
400	12.1	—	10.25	9.9	—

Problems in Atomic-Power Engineering

In the design of nuclear power plants engineers must consider atomic peculiarities. They are here outlined in an ASME paper by Professor Alfred O Nier, outstanding physicist, pioneer in separation of U-235, and consultant on the atom-bomb project

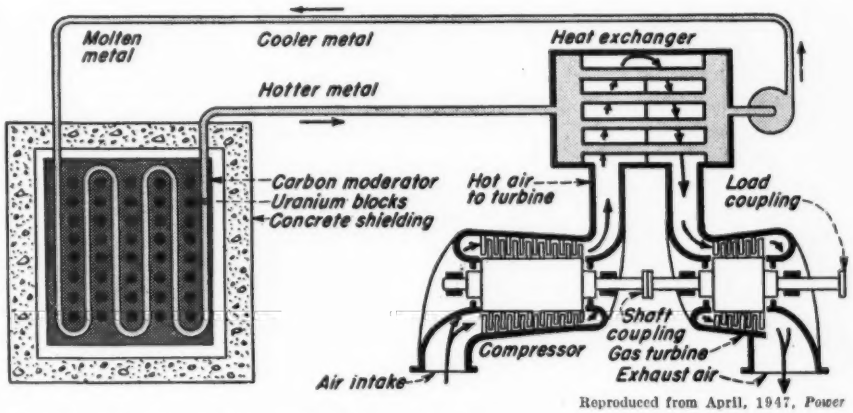
► BEFORE ANY GREAT SCIENTIFIC discovery is put to everyday use, formidable engineering problems must be solved. For example, the fundamental principle of the electric generator was discovered in 1831, but to bring the electrical industry where it is today engineers and scientists, working together, had to solve countless problems.

In the same way, many bridges must be crossed before atomic energy can be used for practical power production. The complex problems demand close cooperation between scientist and engineer that each may understand the other's difficulties. Unlike the steam engine, where all atoms of the working substance are undergoing the same processes, many different processes take place within the atomic engine simultaneously. Some of them compete with one another for atoms. Thus, to understand atomic-engine performance, we need detailed knowledge of the behavior of individual atoms.

Atomic-Power Plant. One schematic drawing on this page shows the new parts of an atomic-power plant. Here, suitable retaining jackets surround the pieces of uranium or other fissionable substance (nuclear fuel). In addition to the fissionable substance, there must be a *moderator*, a substance that slows down the fast neutrons produced in the fission process so they will be useful in producing more fissions.

In operation a neutron strikes a Uranium-235 nucleus, blows it apart into two heavy fragments, each having about half the mass of the original atom. The process also produces loose neutrons. If the device is properly constructed, many of the neutrons produced will in turn strike other uranium atoms, blow them apart, and produce additional neutrons and additional energetic atom fragments. In other words, under proper conditions we will have a chain reaction; the device itself furnishes the neutrons needed to keep the reaction going, and in the process acts as an energy source through conversion of stored atomic energy into kinetic energy of the fragments formed in the fission process.

The kinetic energy is converted into heat, which may be removed for utilization by circulating a suitable heat-transfer fluid around the slugs of fissionable material. A heat exchanger can then produce steam to operate conventional



Reproduced from April, 1947, *Power*

NUCLEAR POWER PLANT. Not shown in diagram are cadmium-control rods, moved in or out of reactor to control power output by absorbing excess neutrons. Author's original paper pictured a steam power plant rather than gas turbines

power units. The arrangement shown is perhaps already obsolete, but it contains so many basic principles it is worth examining further.

Special Requirements. Let's see what some of the requirements of our construction materials are. First, the cans housing the fissionable materials must not absorb too many neutrons. The same may be said of the cooling fluid and the moderator. On the other hand, the rods for controlling the neutron density should be good absorbers, as should the shield surrounding the reactor and heat exchanger. The fuel itself must not absorb too many neutrons in nonprofitable processes, and must contain enough active material so that, as fission products build up and cause a parasitic loss of neutrons, a sufficient excess production will make up for this loss.

Thus the atomic-power engineer must concern himself not only with the ordinary properties of his building materials, such as thermal conductivity and expansion, entropy, enthalpy, corrosion resistance and many others, but lso with the nuclear properties of the materials.

Is there any convenient way to express the nuclear properties? Yes, if we note that collisions of particles or rays with materials cause all the effects in an atomic energy-generation system. This suggests that nuclear properties be described in terms of collision probabilities or of a quantity that we call the *cross section* of an atom. These terms are perhaps new to the engineer, but well-known to the physicist.

Like Duck Hunting. If you are out duck hunting and a flock of birds passes overhead, your chance of hitting one depends directly upon the size of a bird or, more accurately, upon the cross-sectional area that a bird has from your position. Your chance of bringing down a mallard would be much better than of hitting a canary. Moreover, if you could use basketballs rather than buckshot, you would stand a still better chance of making hits. In other words, the chance of a collision between a shot and a duck is proportional to the size of duck and projectile; and so it is with atomic nuclei.

If we send a beam of atomic particles against a block of material, some make collisions with the atoms in the block, others pass through, as in the diagram on page 78. Here 16 particles are striking the front of the block. In the first

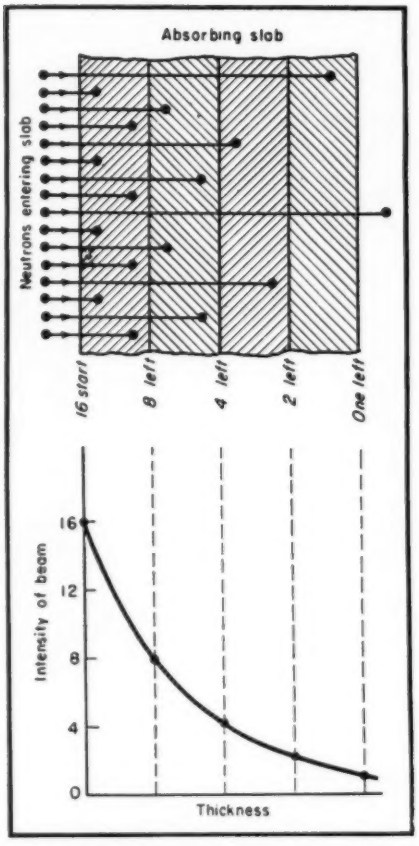
element of thickness one-half, or eight, have made collisions; the remainder pass into the next element where one-half, or four, make collisions, leaving four to pass into the next element. Only one emerges from the block without having suffered a collision. Had the cross sections of the circles (atoms) been larger, none would have passed through the slab without collision; had they been smaller, more would have emerged without collision. So the cross section is a measure of the likelihood of a collision, a large cross section corresponding to a high probability, and vice versa.

Now the term cross section is useful in describing a host of phenomena: We state that U-235 has a certain fission cross section. We refer, of course, to the probability that when a beam of neutrons is sent through a thin slab of material, a collision is made that results in fission. Or, in speaking of the elastic collision cross section of an atom, we mean the probability of collision taking place without energy loss, as in the collision of two perfect billiard balls. These are but two examples of the cross sections atomic physicists talk about. As we shall see, there are others that it is useful to define.

Nuclear Cross-sections. Of what magnitude are atomic cross sections? Usually atomic nuclei behave as if they had diameters of about 10^{-12} cm (one trillionth of a centimeter) or cross-sectional areas of 10^{-24} cm^2 (a trillionth of a trillionth of one square centimeter). This number varies greatly from element to element and from process to process, and for that matter with the speed and nature of the projectile. Thus, stating the value of the cross section has no meaning unless the exact process is defined. Cross sections greater than 10^{-24} cm^2 are generally considered large. So some workers measure cross sections in "barns." The barn represents an area of 10^{-24} cm^2, the implication being that anything as large or larger is as "big as a barn."

What are some of the atomic cross sections we should concern ourselves with in atomic power units? First, there is the fission cross section of our fissionable material. In the following assume that we are using U-235.

When a U-235 nucleus undergoes fission, the neutrons released have a rather high energy. The fission cross section of U-235 is relatively small for high-energy neutrons, but large for really slow neutrons in the thermal-energy range. So if we wish to produce a chain reaction it is advantageous to slow down the neutrons. This may be done by making elastic collisions with atomic nuclei. Thus our reactor should contain some substances with which the neutrons may collide. But in the collisions we must make sure the neutrons are not lost in some absorption process. In other words, the cross section of our slowing down medium, or moderator, should be high for elastic collisions and low for capturing neutrons. In any event, we try to slow down the neutrons in as few collisions as possible since there is then a minimum chance of losing them.



IN RADIATION SHIELD each additional thickness absorbs same fraction of remaining neutron radiation. Here layers and materials are such that each successive layer removes half of remaining neutrons. Sketch is modification of author's original diagram

Ideal Moderator. By the ordinary laws of mechanics, if we slow down an object by letting it make an elastic collision with some stationary object, the greatest amount of energy is lost in a collision if the masses of the two objects are equal. That is, we lose 50% of the energy per collision. This at once suggests that we employ hydrogen as a moderator since the mass of the hydrogen atom is the same as that of the neutron. Thus to slow down a million-electron-volt neutron to an energy of 0.1 electron volt, about 20 collisions would be required. (The electron volt is a unit of energy, representing the amount of energy acquired by an electron which falls through a difference of potential of one volt.)

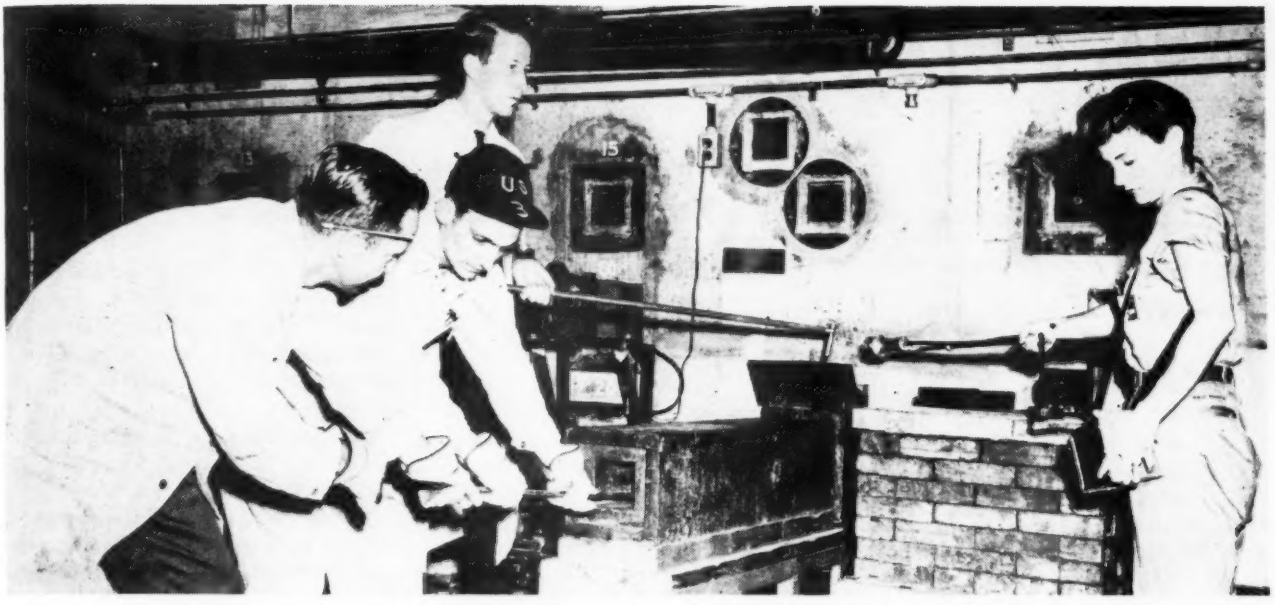
On the other hand, if we chose to lose this energy by allowing collisions with, say, carbon atoms twelve times as heavy as neutrons, we would lose only 14% of the energy in a collision, and would need 123, or six times as many collisions. This is not the entire story for there is a probability of absorption of neutrons in our slowing-down material. As a matter of fact there are a number of elements whose absorption cross section is much less than hydrogen's. Hence they are better moderators in spite of their greater mass.

Helium would be an excellent moderator, but since it is a gas it would be hard to obtain high density of atoms without very high pressures. Ordinary hydrogen is not especially good. Heavy hydrogen is much better. Because lithium and boron absorb neutrons so readily, they are poor substances to use as slowing-down media. Beryllium and carbon, however, are good. Because of the latter's availability as graphite, it is actually used in the chain-reacting piles now operating.

Purity Essential. Extremely pure construction materials will be a necessity in nuclear reactors. For example, if carbon is used as a moderator and contains only ten parts per million of boron as an impurity, the boron will absorb as many neutrons as the carbon itself.

Throughout this problem we must contend with competition between profitable and nonprofitable utilization of neutrons. Thus when ordinary uranium is used as a fuel in a reactor, 139 times as many U-238 as U-235 atoms are present. If we plot the absorption cross section of U-238 against neutron energy, it has a sharp maximum value at a neutron energy intermediate between that of the neutrons produced and the energy required for maximum fission of U-235. So in slowing down the neutrons we stand a good chance of losing a large share as they pass through the resonance region. Fortunately, the effect may be minimized by proper geometrical arrangement of the uranium relative to the moderator. In future, utilization of uranium in which the U-235 has been enriched will further reduce the importance of this factor.

Burning U-235 Generates Plutonium. We have just mentioned that the *resonance* absorption by U-238 diverted neutrons from our main objective, fission of



LABORATORY WORKERS outside heavy concrete shield of uranium pile withdraw sample of radioactive material. Girl checks safety with a Geiger counter—radiation meter. This photograph was not included with author's paper

U-235. But in considering what happens as a result of the absorption process, this is not a total loss. When U-238 captures a neutron, the former is transformed first to Neptunium-239, then to Plutonium 239. It turns out that Pu-239, like U-235, undergoes fission when struck by neutrons of the proper energy. Thus while we are losing U-235 we are gaining the equally valuable Pu-239. Since only 1/140 of the uranium atoms in nature are U-235 we see the economic consequence of the plutonium creation. If things could be so arranged that for each U-235 atom lost one or more Pu-239 atoms were created, we would soon dispense with utilization of U-235. We would "burn up" the 139 times more abundant U-238 instead of the rare and precious U-235. Even if this goal is never achieved, production of some Pu-239 will reduce the demand for U-235.

The same argument holds for production of U-233 from thorium. If any neutrons over and above the minimum required to keep the chain going could be diverted into making U-233, drain on the U-235 stock would again be lessened. It would be replaced by a drain on the much more abundant thorium. These "ifs" are pure conjecture. The practical usefulness of the processes remains among the future's interesting problems.

Removing Fission Products. When an atomic fuel undergoes fission, elements near the middle of the atomic table are formed. For each U-235 atom destroyed, two new, lighter atoms are created. Some of them have a low cross section for absorption of neutrons. Others have larger values, and act as parasites in removing neutrons from the pile. Thus in any practical atomic "furnace" the waste products must be removed.

Hanford Plant solved the problem by removing the canned uranium slugs at regular intervals, dissolving the contents by a laborious chemical process, and separating out the uranium and plutonium for further work. The fission products are so strongly radioactive that all chemical manipulation had to be done in batch processes by remote control behind thick concrete shields. Replacement of batch handling by continuous methods should be a challenging problem to the engineer. It would do much to lower atomic-energy cost.

You have all seen figures showing that if one pound of uranium, an amount about the size of a golf ball, undergoes fission, the energy released is roughly equivalent to 200,000 gallons of gasoline. This is enough energy for the average motorist to run his car 200 years. Unfortunately there is a hitch in all this. It is estimated that for a human being to be safe near an atomic reactor, at least 50 tons of shielding material are required—an amount somewhat more than your automobile is able to stand.

Problem of Shielding. Why must such heavy shield be employed? What is it we are shielding against? First, there are the neutrons, particles that make chain reaction possible. As already indicated, for efficient operation of the reactor as many as possible of the neutrons should be utilized in producing more fissions. This suggests that the pile be surrounded by an envelope of an element with the property of readily reflecting neutrons without absorbing them. While such an envelope helps reflect a fair proportion of the neutrons that would ordinarily escape back into the pile, it would still permit many to leave. Thus to protect personnel, additional neutron-absorbing material is required.

Many of the fission fragments are highly unstable and decay to form more stable atoms. In the process gamma rays are emitted. These, like X-rays, are electromagnetic, but because of higher energy are more penetrating. Like X-rays, they are most readily absorbed by the heavy elements. In practice, concrete has been an absorber for both neutrons and gamma rays.

This discussion might be summarized by stating that the problem of producing atomic energy is largely one of making efficient use of neutrons. This and the concept of atomic fission are really the only basically new factors the engineer must contend with. Otherwise, the problem of producing atomic energy involves merely modifications of problems that engineers have already solved or will solve in other work. Thus many developments will go hand in hand with those being carried on in industry. Engineers can contribute substantially toward making atomic energy an everyday reality by merely extending their scope of operations.

Tips For Air-Conditioning Engineers

Look for small defects that may hold down performance and cause complaints from building occupants. Here are suggested ways to get maximum benefit from an air-conditioning system

By JOHN D CONSTANCE, *Professional Engineer*

▶ AN AIR-CONDITIONING SYSTEM usually represents a sizeable investment and, to be justifiable, it must pay dividends in one form or another. Perhaps, it is installed primarily for comfort, and the return is based on increased sales or employee efficiency.

On the other hand, process control may demand that air conditions be held within close limits. Here the return is reflected in a more uniform product, fewer rejects and increased production. Whatever the reason for installation, it is up to the engineer to keep the system operating at maximum efficiency and minimum cost.

External Load. Of prime importance in keeping costs down is the reduction of external cooling loads. For example, sun heat on a flat roof directly over an air-conditioned space can be greatly reduced by maintaining a 1½- or 2-in. depth of water on the roof deck. Hoppers or drains carry away excess. More water, if not in circulation, will not cool overnight and acts as a heating surface to keep room temperatures up. Two inches of stagnant water is about equal to 4 in. of many other types of insulation. Ice formation in winter provides as good an insulator as the water.

A water film on a roof reflects the sun's rays and lowers inside temperatures 12 to 15 F. Even the beneficial results gained from holding rainfall on the roof are worthwhile. The water will last from four days to two weeks, depending on wind and weather conditions. Aside from the insulating and reflecting qualities of the water, it offers the advantage of increasing roof life by some 50%, because heat from the sun and other weathering conditions deteriorate roof material rapidly.

When further and more effective cooling is desired, sprays and a recirculating water system can be installed. The sprays keep the roof cool and consequently it does not transfer any appreciable amount of heat into the building. Main precaution is to be sure the roof structure will support the additional load. Also the roof reservoir must be free of sharp corners and curbing if ice insulation is to be permitted during winter months.

Main disadvantage of a stagnant film of water is that in certain climates algae growth tends to destroy roofing materials. Where local ordinances permit, it is good practice to spray the refrigeration condensing water on the roof. Circulation reduces algae growth.

Installing window shades, venetian blinds, and awnings on those sides of the building having prolonged exposure to the sun is of benefit. Most effective are outside shades. Awnings, however, are more effective above the first floor because heat reflected from the ground is less noticeable at higher elevations.

Transmission Loss. The insulation between roof joists and down the sidewall spaces reduces heat-transmission losses to one-fourth their former value. Ordinarily, 3 to 4 in. of insulation is used. A word of caution on this type of insulation may possibly prevent future headaches: Where high relative humidities are constantly maintained in winter, water vapor from the inside area tends to pass through the insulation. If a vapor barrier or impervious membrane is not applied to the side nearest the conditioned space, the water vapor will condense on and in the insulation. Reduced resistance to heat transfer and water-logged walls and insulation result when mild weather melts the ice that has formed.

EXHAUST LOCAL HEAT

Local sources of heat such as coffee urns, steam tables and stoves should have properly designed exhaust hoods, Fig. 1A, that connect to a blower exhausting outdoors.

Duct Work. On our way to the air-conditioning plant, let's first inspect the duct work and follow the air path from intake to outlets, noting as we move along that certain integral parts require fairly frequent attention.

The first object that incoming outside air meets is the intake louvers and screen. This protective structure usually mounts in a very out-of-the-way place, often inaccessible from outside. It is quite common for the intake to become clogged with flying leaves and papers. This debris must be removed so that the design quantity of outside air may enter. Then, too, normal weathering of the sheet metal and screening leaves the surfaces unprotected against atmospheric corrosion. If they are not made of copper, keep them well protected with paint. It is good practice to provide a door just downstream of the intake for inspection, clean out and painting.

If louvers and screen are of copper,

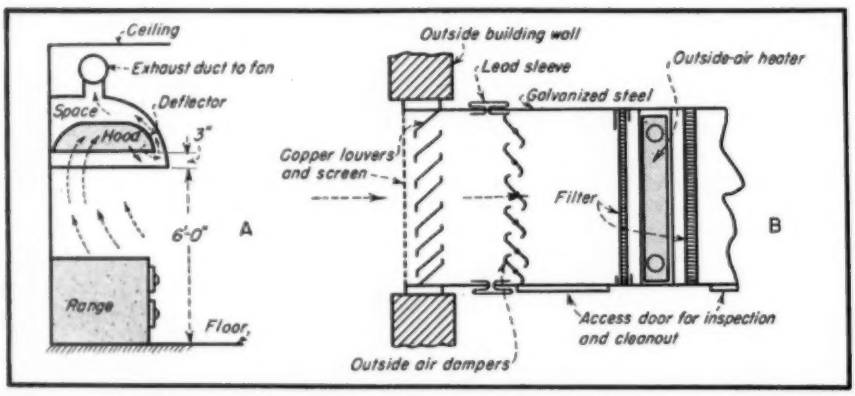


Fig. 1—(A) Fit local heat sources with hoods that connect to blowers exhausting outdoors. (B) Lead sleeve prevents galvanic action between copper and steel

a lead connecting sleeve. Fig. 1B, prevents galvanic action between the copper and steel air duct. Unless this preventive measure is taken, corrosion takes place at the expense of the steel members.

DAMPER CARE

Next come the outside dampers. If manually adjusted, they require no particular attention except an occasional oiling and a check on their setting. On the other hand. if automatic spring-return dampers and a damper motor are provided, proper lubrication is important. A well-maintained mechanism will last the life of the system while rusty pivots and sprung damper blades create an undue strain on interconnecting linkages and cause erratic and uncertain operation of the entire mechanism.

When the duct system serves for winter tempering of outside air, the intake chamber is often provided with a preheat coil. This unit is usually of the extended or fin type, using steam or hot water as the heating medium. Unless protected, the coil picks up considerable dirt which, if not removed, clogs the passages. It is, therefore, logical to provide a filter ahead of the coil with an access door in the ductwork for inspection and cleaning. If the coil is located close to intake louvers, a common access door could be provided.

How often the filtering equipment should be cleaned or replaced depends on personal judgment and local conditions. Indicating draft gages that measure the static pressure drop across the filter bank may be used to advantage. But they should not be depended upon entirely; make a periodic visual inspection of the filtering surfaces.

KEEP PREHEATER CLEAN

No practical filter of the replacement type will prevent all dust and dirt reaching the preheater. That which does reach the hot surfaces bakes fast, and not only reduces the heat-transfer rate but eventually builds up into thick cakes. In time, this mass disintegrates, passes through the coil and into the main duct system. Exercise care to see that the coil is drained when not in use, unless it is a non-freeze design.

Simple draining is not enough; blow the coil free of water with air under pressure. Preheating coils must not only be made accessible but should have flushing pans so that water from a flushing hose may be collected and led to drain. If possible, install a second set of filters, as accessible as the first, on the downstream side of the preheat coil. Provide access doors or inspection panels with gaskets to make them leakproof.

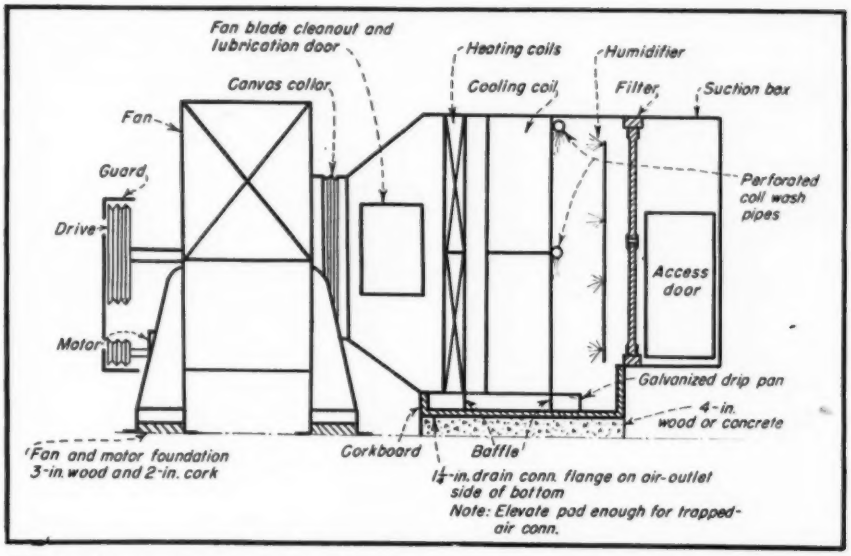


Fig. 2—Keep galvanized-steel drip pans protected with good grade of paint because locating leaks involves a painstaking and time-consuming operation.

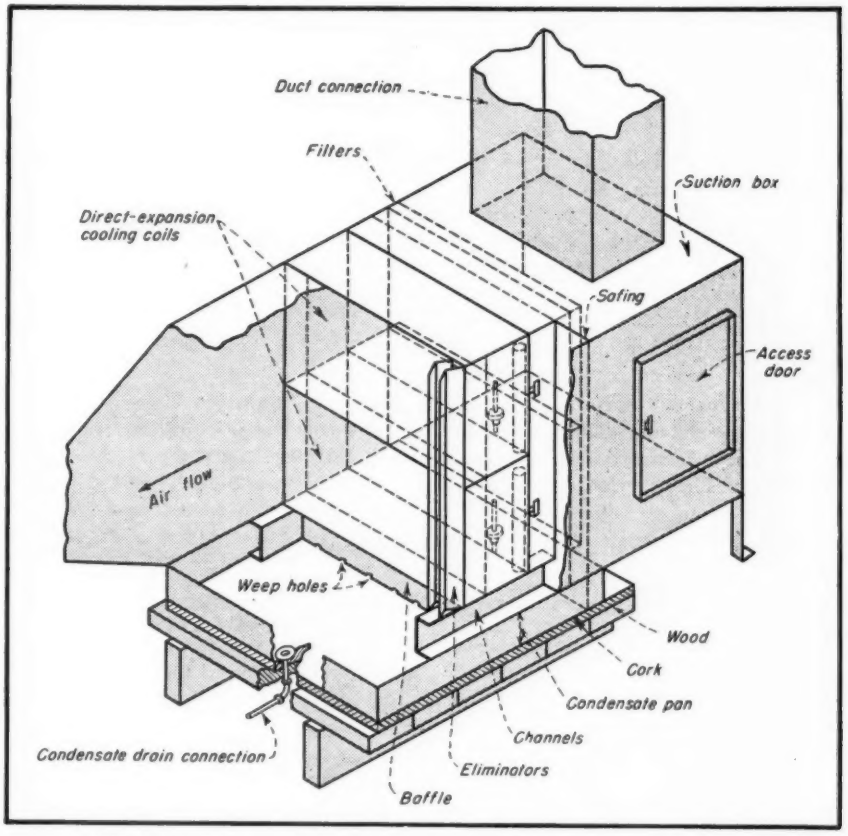


Fig. 3—Missing safing or blank-off pieces permit air to bypass around the cooling or heating coils. This condition shows up in incorrect air temperature.

Condensation. During summer operation, outside air, having a higher dewpoint, deposits moisture when passing through unconditioned areas which are at or below dewpoint temperature. The condensed moisture may collect and drip out the ductwork at connecting seams and collars. It not only corrodes the duct but the dripping may damage merchandise or exposed equipment.

In winter operation, cold air causes condensation on external surfaces of the intake air duct with consequent

corrosion and dripping where it passes through areas of high humidity. Such ducts are usually insulated. If the insulation is damaged or inadequate, make repairs or apply additional thickness. Remove rust spots on the ductwork and repaint.

Pipes carrying steam or other hot fluids through ductwork must be inspected frequently and the insulation kept in repair. Heat added to a cooled air stream or unusually rapid condensation of the steam in such a section of piping will, in the first instance, add to the refrigeration load, and, in the second, cause water hammer and sluggish steam flow.

AIR-CONDITIONING UNIT

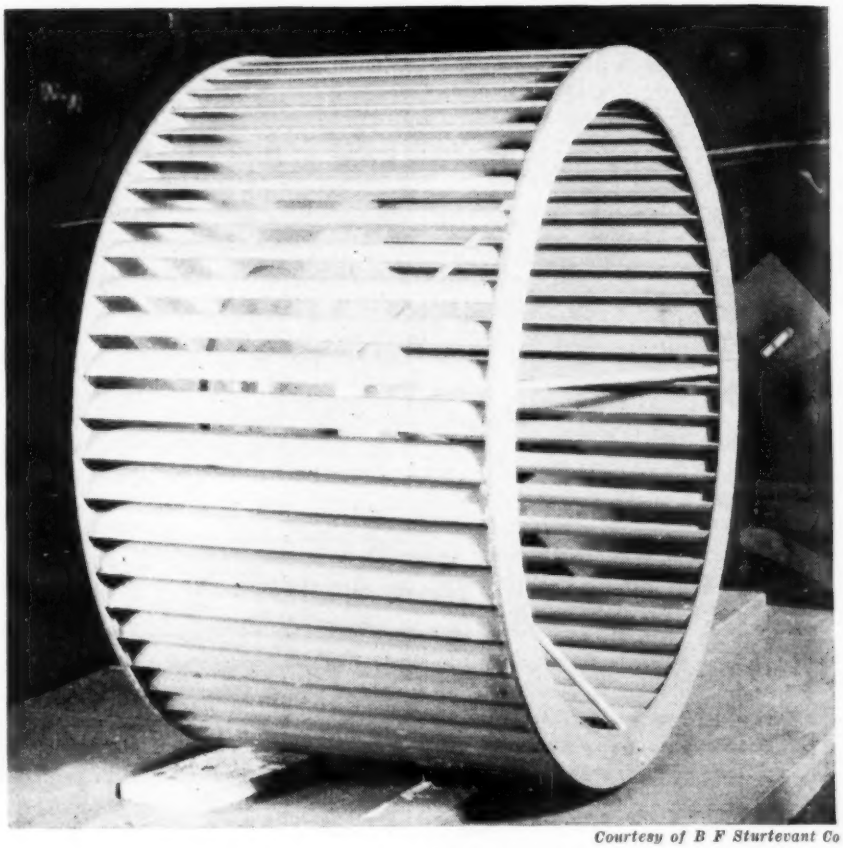
Outside air is mixed with recirculated air at the air-conditioning unit. Locating leaks in the drip pan is a painstaking and time-consuming operation, as indicated in Fig. 2 and 3. Best way out is to replace the pan. In itself, this is comparatively inexpensive. The operations necessary for removing and replacing the refrigerant and drain piping, however, require pumping down the refrigeration system. So the time taken to keep the drip pan and casing protected with a good paint obviously pays.

Motor and fan bearings must be kept well lubricated. Check belt tension to hold belt and bearing wear to a minimum. Horsepower requirements will also be reduced. Even with all the care taken to prevent dust entering the system it does accumulate on fan wheel and blades, Fig. 4, which reduces the unit's air handling effectiveness. It may even throw the wheel out of dynamic balance.

COIL WASHER

Leaks at seams and access doors may be easily eliminated by calking and replacing gaskets. Installing a single perforated water header across the face of the coil bank at the top is helpful in keeping the fins free of dirt. By simply opening a valve the accumulated dirt may be easily flushed down into the drip pan.

Common Defects. Too often the extended surface fins on the coils are accidentally flattened during installation or pan cleaning. Thus, air flow is blocked at these points. Also the safing or blank-off pieces around the cooling coils are sometimes omitted. This bypasses the unconditioned air stream around the coil bank, resulting in less sensible cooling. Filters at this point need periodical inspection and cleaning. As at the intake, a static pressure instrument is useful to indicate pressure drop across the filter bank. The condensate-drip drain at the pan should have a clean-out trap.



Courtesy of B F Sturtevant Co

Fig. 4—Dust and dirt sticking to the fan wheel reduce the unit's air-handling effectiveness. The resulting unbalance may cause the fan to vibrate badly

During intermediate seasons when outside air is used exclusively to cool the spaces, fan speed may be stepped up to circulate more air. Take care not to overload the fan motor by more than 10% of nameplate reading. There is a limit to the face velocity of air across the coil. At speeds above 600 fpm condensate is carried through, resulting in corrosion to the fan wheel and casing unless eliminators are installed, Fig. 3.

Quite often the unit casing insulation cracks at the joints. A 50-50 mixture of asbestos fiber and Portland cement applied with a trowel returns the coating to its original effectiveness. Canvas collars at the fan and air-unit casing must be free to isolate vibrations set up by the fan. But sometimes the canvas is covered with several coats of paint, creating a hardened condition of the fabric. Spray nozzles should be examined for clogging. A routine check of all strainers for excessive accumulation of dirt keeps down operating pressures. Felt lining used to treat the ducts acoustically must be inspected for wind erosion.

Anemometer Check. Measuring air distribution at grilles assures correct air flow and exposes loose dampers and splitters. Extra duct runs added to the original distribution system may throw the scheme out of balance. Also indiscriminate installation of exhaust fans requires an increase in the total air handled by the conditioner to retain positive pressure in the conditioned space.

Evaporative Condenser. This water saver is seldom equipped with air filters and atmospheric debris has a good chance of entering the unit and cluttering the pan, coils and fan blades. Frequent cleaning is a must. Any loss in heat-transfer rate correspondingly boosts the head pressure and with it the electric consumption of the compressor motor. Checking the float mechanism, cleaning out the water strainer and screen, purging the condensing coil and lubricating the motor and fan bearings should be part of routine inspection.

Usually evaporative condensers stand outdoors. Don't overlook corrosion resulting from the weather while concentrating on the treatment against im-

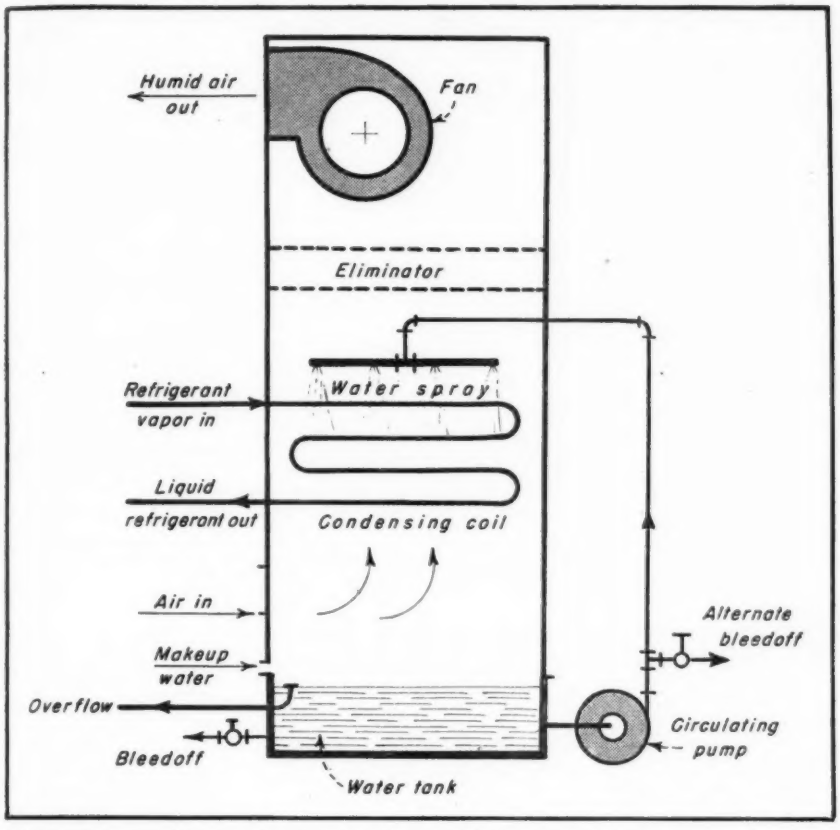


Fig. 5—Evaporative condensers standing outdoors are subject to corrosion from weather. Watch for excessive solids concentration in the circulating water

purities concentrating in the water circuit. Where excessive scale builds up on the water side of the coil open the alternate bleedoff on the circulator discharge, Fig. 5, and allow a fraction of the water to go to waste. Amount of bleed depends on the rate of concentration, as affected by water impurities.

Compressor and Evaporator. Most economical and convenient time to service the refrigeration assembly is during the winter months when it is not in operation. If the unit uses a shell-and-tube condenser instead of an evaporative one, the water-regulating valve should be checked for proper operation. If the valve seat is worn, replace it with a new one. Valve stem should be free and not prone to sticking.

Valves, oiling system, pistons and cylinders should be carefully checked for wear every five years. Scored and pitted cylinder walls require reboring or new liners. Worn piston rings must be replaced. Examine the motor-starter contacts and dress with a file or replace. Check the overload protection for proper operation and rating. Be sure the starter operates in response to the various control devices. If the plant consists of two compressors operating in parallel, oil-equalizing connections should be made an integral part of the system. Units so arranged must have a 6-hour off-period out of every 24 to allow machine oil levels to equalize.

Usually the superheat adjustment on thermostatic expansion valves is set for a 10-F superheat which ensures dry suction vapor to the compressor. Wet vapors not only show a loss in evaporator efficiency but endanger the compressor itself. A gage cock and thermometer well in the suction line close to the evaporator outlet prove helpful in checking superheat.

When starting up after a prolonged shutdown and before the refrigerant is released from storage in the condenser-receiver, check the compressor shaft seal for tightness and lubrication. It is a wise operator who installs a permanent set of suction and discharge gages on the compressor, Fig. 6. Higher than normal head pressures indicate poor condenser operation. Lower than normal suction pressures indicate priming of the suction line from uncontrolled refrigerant flow into the evaporator.

Water-Cooled Condensers. Clean the condensers before each cooling season. Any change that ensures normal condensing pressures materially lowers power consumption. Condenser should be purged of accumulated air and other non-condensable gas. Clean all heat-transfer surfaces of slime and scale. Bacterial corrosion products may be removed by giving the entering condensing water a shot of chlorine at certain predetermined intervals. Red-brass tubes are recommended where brackish water is used for condensing purposes in a refrigerating system.

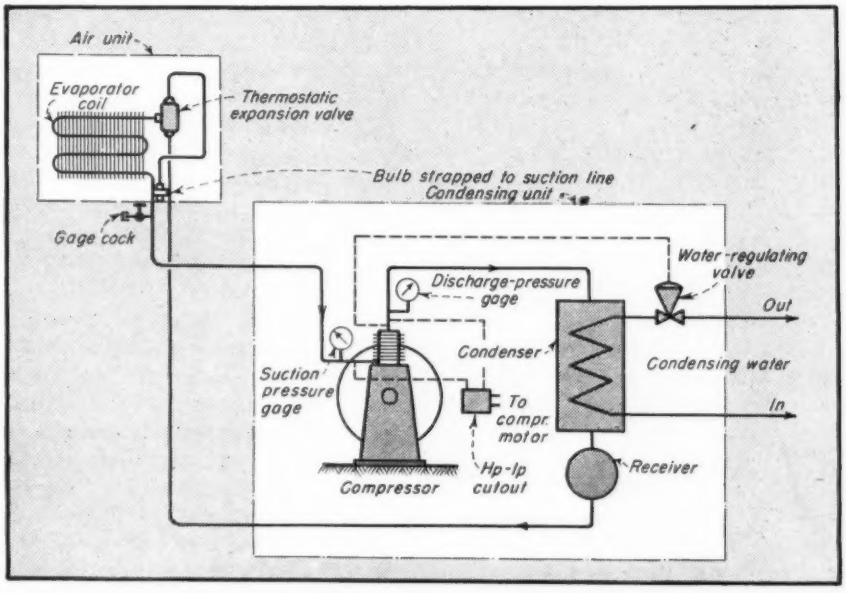


Fig. 6—Suction and discharge gages on the compressor give indication of poor evaporator and condenser performance. They are a must for good operation

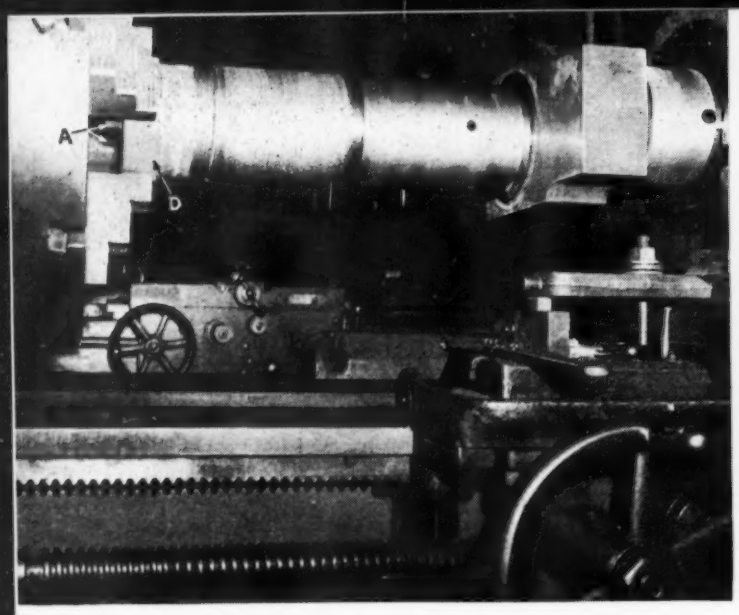


Fig. 1—Disk D was bolted to the crankshaft's stub end to support it in the lathe chuck jaws. Two of the tap bolt heads holding disk D to shaft end can be seen at A

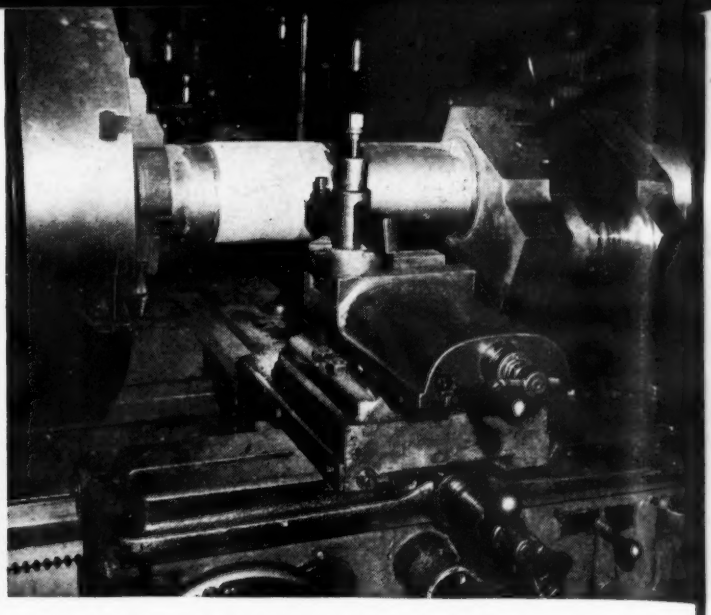


Fig. 2—The stubshaft that will support the flywheel has been turned down and the rough cut is being made for a sprayed metallizing build-up with stainless-steel wire

Pressed Fit on Crankshaft Stops Overhung-Flywheel Wobble

During ten years' operation of diesel-driven compressors, flywheels that overhung on crankshaft stub ends worked loose persistently. Building up the stubshafts with stainless steel and refitting the flywheels to them corrected the trouble. The crankpins and bearing journals were also trued in the lathe

By ELTON STERRETT, *Houston, Texas*

▶ WE RECENTLY RECONDITIONED a battery of 600-hp angle-type diesel-driven compressors, having eight power and four compressor cylinders. The plant, which had been running 24 hours a day for nearly ten years, took time out only for needed servicing, valve renewals and bearing adjustments. Reconditioning of all units was decided upon primarily because the flywheels became loose on the stubshafts. These wheels are cast, with their hubs slotted nearly to their edge, at right angles to the keyway. Two bolts, working across the slots, were depended on to clamp the wheels tightly on the shaft ends. Early in operation the flywheels began to work loose. The engineers tried to tighten them by pulling down on the hub bolt nuts, which sometimes stopped the wobbling temporarily, but caused breakage of some of the flywheel spokes.

Drawing up on the hub bolts set up stresses that were transmitted through the spokes to a point near the heavy rim. Here, cracks developed which made it necessary to replace the flywheel, but such replacements failed to cure the trouble.

Shaft Wear. When the flywheels were pulled off their shafts, wear was found in four rather narrow areas, lying parallel to the shaft axis, and positioned roughly 90 deg apart, with two areas 45 deg away from the keyway, Fig. 3. Because four areas were damaged instead of only a pair diametrically opposite, we raised the question of whether wheel wobble could cause the markings. Investigation determined that these areas were located where tightening the hub bolts put greatest pressure on the shaft. From this condition we drew the conclusion that the discolored material lying in each of these areas was a product of stress corrosion, rather than abraded material.

Refitted the Flywheels. After reconditioning one shaft in place, which interfered too much with plant operation, we decided to condition the others in a shop. The other units were dismantled one at a time, the crankshaft removed and secured to a stiff channel-iron skid to prevent distortion or overstressing during the truck haul to the machine shop. In the shop the flywheel hub was rebored and the wheel rebalanced, if necessary, before working on the crankshaft.

Crankshaft in Lathe. Before supporting the crankshaft in the lathe we bolted a disk *D* to the end of the stub that supports the flyweel, Fig. 1. This disk, about 6 in. in diameter, was held in the faceplate jaws to permit rotating the shaft in the conventional manner. The flywheel section was then turned down, Fig. 2, to remove all traces of the corroded areas and given a rough cut preparatory to building up the shaft with sprayed metal.

Before spraying the shaft a filler strip, or dutchman, was fitted in the

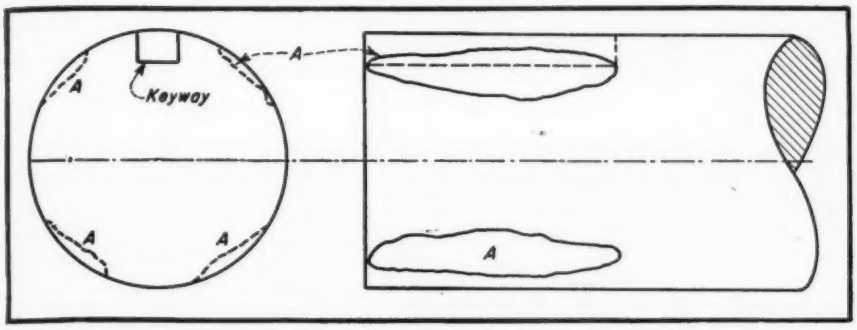


Fig. 3—Diagram shows location of the keyway in stubshaft and areas A of the greatest stress corrosion. This damage occurred at about 45 degrees on each side of the keyway and flywheel-hub split, at right angles to the keyway

keyway to carry the metal spray and tool across it without breaking the metal's edges. We carefully cleaned and washed the keyway with carbon tetrachloride before placing the filler in it so that oil would not bleed out during spraying to destroy the bond between parent and applied metals. If metal spraying was delayed after the shaft was conditioned, a thin protective coating of stainless steel was sprayed over the surface to prevent incipient corrosion and insure proper bond between the spray metal and shaft when work was resumed.

Shaft Sprayed With Metal. After conditioning the shaft we built it up, by spraying with No. 302 stainless-steel wire, to a diameter that permitted turning down to fit the rebored flywheel. Finished diameter of the shaft was made equal to that of the flywheel-hub bore, plus 0.001-in. per inch of bore diameter.

Since the rebuilt section of the stubshaft did not run in a bearing the stainless-steel surface was finished for a static instead of a working fit. To put the flywheel on the shaft when it was returned to the engine, we first drove wedges into the hub's slots to gain clearance that permitted jacking the wheel into place. When the wedges were removed, the hub's spring held the flywheel on the shaft without heavy loading of the hub bolts.

Crankpins and Bearing Journals. While each crankshaft was out for reconditioning the flywheel stubs, all bearing journals were trued to remove the scored areas, flat spots and other defects caused by 10-yr operation. When truing the crankpins we checked them for minimum diameter and turned all to this dimension, using an air-motor driven tool, mounted on the lathe's cross-slide, Fig. 4. Before truing the crankpins the crankshaft was supported in the lathe in two steady rests *S*, Fig. 5. Two jacks, one of which is shown at *J*, were also used to help hold the crankshaft motionless in the lathe. A jack was placed under opposite crankshaft throws and adjusted against the lathe ways.

Crankpin Truing Tool. The crankpin truing tool consists essentially of a worm-drive unit with a supporting ring and tool ring cut across their diameters and bolted together. Making the rings in two parts permitted assembling the truing device around a pin without disturbing the crankshaft setup in the lathe. Tool *T*, Fig. 4, is supported in the driving ring that rotates it about the pin. The driving ring can support the tool on either side so that by simply transferring the tool from one side to the other a cut can be made for the pin's full length.

Machining of the crankpins was a nice bit of machine-tool work. The two halves of the cut matched so closely that careful micrometer measurements failed to show where the tool was changed.

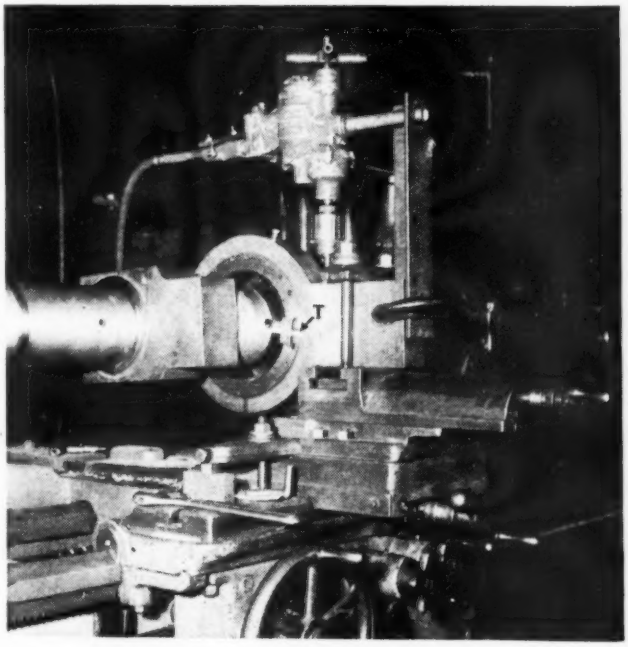


Fig. 4—Setup of the air-driven crankpin truing machine showing the tool T clamped to the worm gear's rim. Tool can be dismantled and reassembled around another pin

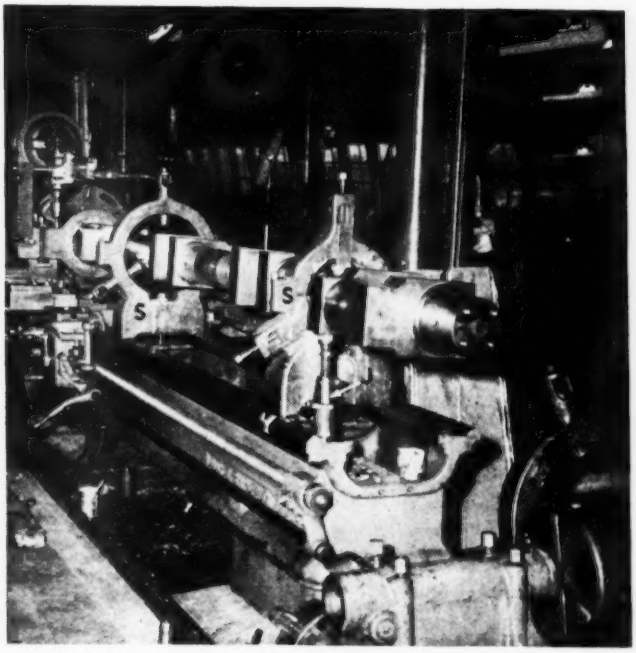


Fig. 5—Crankshaft in lathe with two steady rests and pair of jacks under opposite throws of the shaft prevent shaft motion or rotation while truing the several crankpins

Mercury-Pool Rectifiers Supply DC

Industrial plants and other systems use single-tank mercury-pool rectifiers extensively to supply dc from ac power. S R Durand, rectifier-application engineer, Allis-Chalmers Mfg Co, tells how these rectifiers operate, are constructed and controlled to supply dc in the correct amounts and at right voltage

Fig. 1—Six-tank 1000-kw 600-v mercury-pool rectifier in background, with its control cubicle in foreground for supplying dc power to traction system. On cubicle door are grid-circuit rheostat knob to adjust output voltage by phase-shift control and pushbuttons to operate the auxiliary-power supply contactors

▶ Because of their higher efficiency and other advantages, mercury-pool rectifiers have replaced to a large extent rotating-converting equipment for changing ac to dc, for 250-v and higher-voltage services. Until recently these rectifiers were multi-anode designs with as many as 24 anodes in a single tank. Modern designs are mostly single-anode tank or tube units, grouped to form a rectifier of the desired capacity.

Single-Anode Rectifiers. These units are two general types, ignitrons and excitrons. They are similar in appearance and applications, but differ in the method to start and maintain the arc in them. In the ignitron the arc is started each cycle by an igniter in the mercury pool. The excitron, with which this article deals, starts and maintains a dc pilot arc on the mercury pool. Firing control of the main arc current between cathode and anode is regulated by a grid.

Rectifier Construction. Fig. 2 shows a cross-section of an excitron single-tank rectifier. An insulator set in the anode plate supports the graphite anode. Mercury seals with rubber gaskets form vacuum-tight joints between the insulator and anode plate and shaft. A small gage glass shows the seals' condition. If leakage occurs, mercury level drops in the gage glass, which indicates that pressure on the seal gaskets must be increased. Heavy steel springs maintain pressure on the upper vacuum-seal flange and compensate for anode steel-shaft expansion caused by heating. Anode plate supports the main anode, grid, excitation anode, mercury-arc baffles and internal cooling coil so these parts can be handled as a unit to simplify assembly.

Graphite Grid. A large petticoat of the anode insulator supports the graphite grid by steel sleeves. A Nichrome wire connects the grid to an enameled grid-terminal rod sealed in the anode plate. Four skirts, separated by deep grooves in the lower part of the anode insulator, provide high insulation between anode and grid.

Arc Baffles. Graphite arc baffles and the internal cooling coil are supported by the coil's inlet and outlet connections, which pass through vacuum insulation pressure-type seals in the anode plate. Compressed springs between bolt heads and top flange maintain pressure on these seals.

Insulating the internal cooling coil

When and Where You Want It

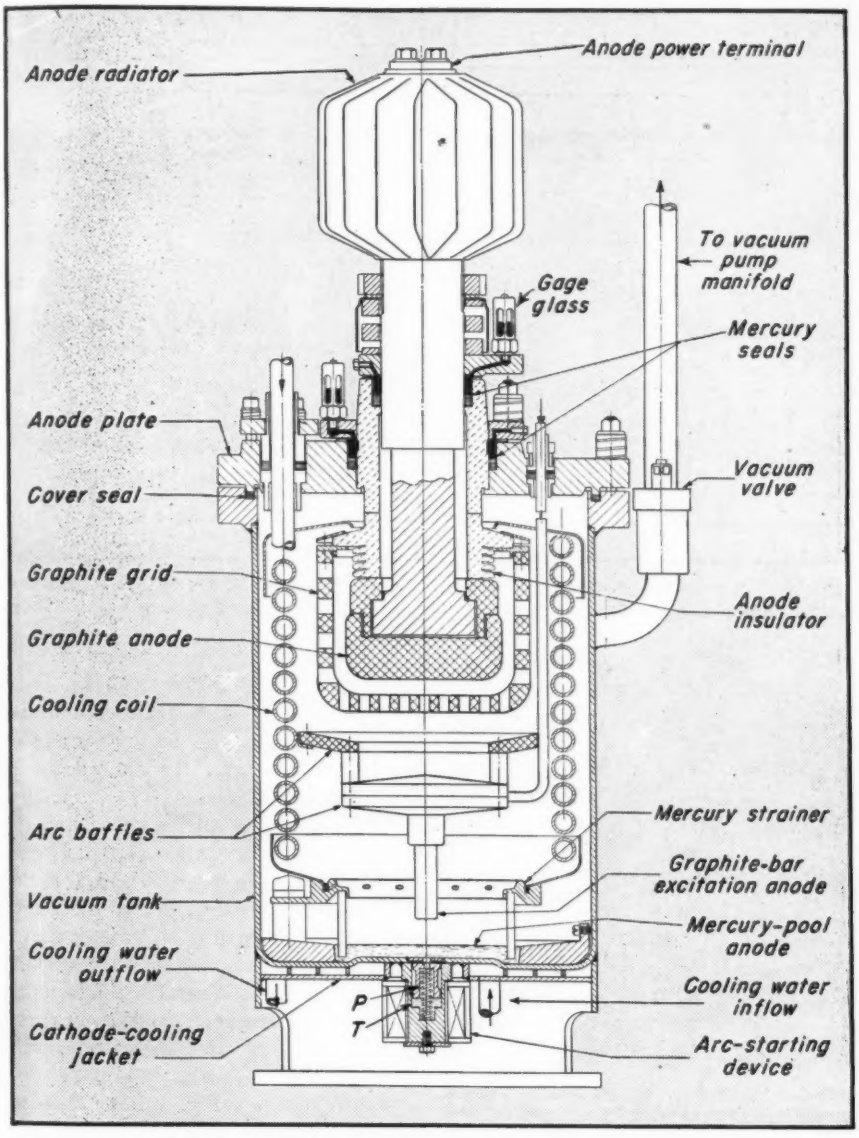


Fig. 2—Cross-section through single-tank mercury-pool rectifier shows graphite anode and its steel supporting shaft in an insulator, held in anode plate along with graphite grid, mercury-arc baffle, mercury strainer, mercury cathode, excitation anode, arc-starting device and tank and cathode cooling systems

from the tank prevents an arc starting between tank wall and anode. A slight space between cooling-coil turns lets mercury vapor condense over the entire area of each turn to provide a large condensing surface, which permits carrying heavy arc currents and high short-time overloads.

Excitation Anode. A graphite-bar excitation anode set in a lava insulator is supported in the lower arc baffle. An electrical connection is made between this anode and its sealed-in terminal rod in the anode plate. During operation, a pilot arc is maintained between the excitation anode and the mercury pool.

Cathode Assembly. Before placing the anode plate on the tank, the cathode assembly is made in the tank's bottom. This asembly includes the pilot-arc starting device, spacing ring to confine the mercury pool in the center of the tank, and the insulated supports for the mercury strainer.

Mercury droplets from the cooling coil collect in a steel ring and flow through the strainer back into the cathode pool. Graphite dust or other particles float on top of the mercury in the strainer ring groove, and do not enter the pool. When the anode-plate and cathode assemblies are completed, the anode plate is lowered to the tank and a vacuum seal is made by a rubber gasket in a groove in the tank's top flange.

Main Arc Path. The main arc, when firing between mercury pool and anode, is turned by the lower arc baffle, and passes through the center hole in the upper arc baffle and the lower holes in the graphite grid. The lower arc baffles separate the tank into an upper and a lower zone to (1) protect the anode and grid from radiated heat of the cathode spot on the mercury pool and (2) better control the mercury vapor in the critical zone surrounding the anode.

Because the cathode spot on the mercury pool reaches a high temperature, the cathode is cooled by water that enters near its center and flows in a spiral channel around the bottom of the cathode plate surface before reaching the outlet pipe. From this pipe, the water circuit connects externally to the inlet of the tank's cooling coil by an insulating tube. After flowing down through every second turn of the cooling coil and back up through the alternate turns, the water again discharges through an insulating tube to the drain pipe.

Arc-Starting Device. Each time a unit is put in service, pilot arcs are first started in each tank. The arc-starting device has steel tube *T*, Fig. 2, with a thin-wall section, welded to an opening in the tank's base. A plunger *P* is held by a spring against the tank's bottom and a hole through the plunger's center permits tube *T* to fill with mercury from the cathode pool.

An external coil surrounds tube *T*. When this coil is momentarily energized from a 230-v ac auxiliary supply, plunger *P* moves downward and forces mercury up through its center hole to form a jet that momentarily closes the circuit between the pool and the excitation anode. The coil is energized under timing control for only a fraction of a second. As soon as it is deenergized the spring returns the plunger to

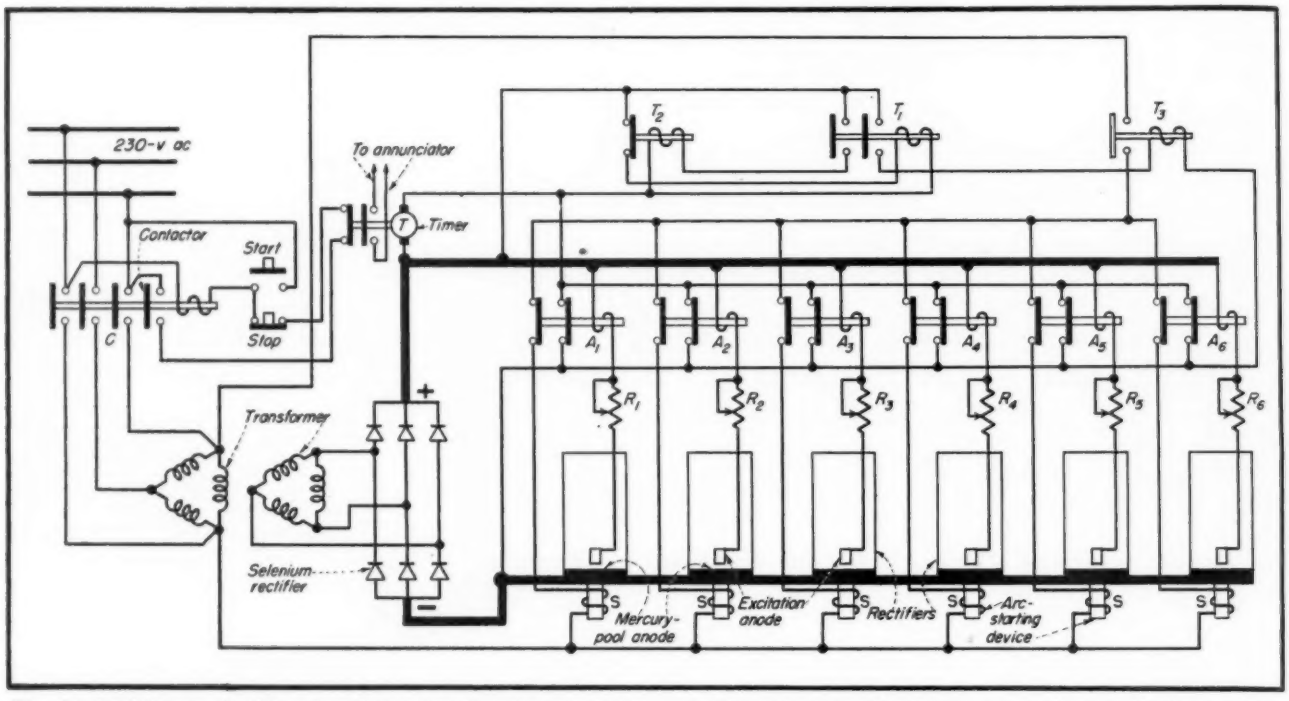


Fig. 3—Ignition excitation circuit for 6-tank mercury-pool rectifier. Pressing button initiates excitation by closing contactor C to supply dc power to the excitation system from 3-phase full-wave 50-amp 35-volt selenium rectifier

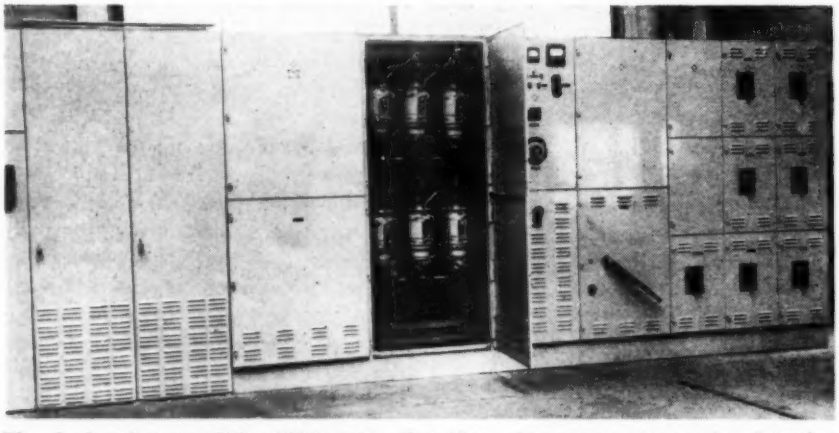


Fig. 4—Load-center 250-v 500-kw dc substation. Open door shows six of twelve sealed-off mercury-pool rectifier tubes. Switchgear and rectifier transformer are inclosed in sections on left of rectifier, with dc breaker sections on right

its original position. Collapse of this jet opens the circuit to produce a dc pilot arc so that cathode-spot excitation forms on the mercury-pool. A selenium-plate rectifier through a current-adjusting resistor supplies pilot-arc current of 7 or 8 amp to each tank.

Pilot-Arc Circuit. Fig. 3 shows the ignition-excitation circuits for a 6-tank rectifier. The system is energized by operation of contactor C, actuated by closing the start pushbutton. This applies a 35-v dc potential to the excitation anodes of each rectifier tank, obtained from a 230-v 3-phase transformer and a 3-phase full-wave 50-amp selenium rectifier. The circuits of each excitation anode include a relay coil, A_1 to A_6, and a current-adjusting resistor, R_1 to R_6.

When the dc excitation circuit is made alive by the selenium rectifier, a timing-control circuit is also energized to establish the pilot arcs automatically. This circuit includes a time-on relay T_1 and a time-off relay T_2, which are mutually interconnected to actuate a small contactor T_3. This contactor causes all arc-starting device coils to be energized from the 230-v ac auxiliary supply for about 0.3 sec, and then to become deenergized for the remainder of the second. In this time, if any pilot arc fails to start and its relay does not pick up to open the starting-coil circuit, the timing cycle repeats.

When all pilot arcs have started so that all excitation relays A_1 to A_6 are energized, timing control relays T_1 to T_3 cease to function. If a pilot arc fails to start because of some fault in its circuit, the timing control circuit will function for several seconds until a timer T times-out, and causes an alarm to sound and indicate failure of a pilot arc to start.

Applications. Fig. 1 is a 1000-kw rectifier with its control cubicle, which supplies 600-v dc power to an electrical traction system. The control cubicle contains the auxiliary-control equipment for the unit. Pushbuttons for operating auxiliary-power contactors in the control circuits are on the front of the door, as well as the grid-circuit rheostat knob for adjusting the dc output voltage by phase control, a light annunciator, small voltmeter, and vacuum meter.

Sealed-off mercury-pool tubes are used for rectifier equipment at ratings from 150 to 500 kw. Construction of sealed-off tubes is similar to pumped tank designs and they are also water-cooled. After assembly of the electrodes on the anode plate and the cathode parts in the tank, the plate is

(*Continued on page* 158)

Fig. 1—Plant extension follows dimension and architecture of existing structure, yet has larger capacity units

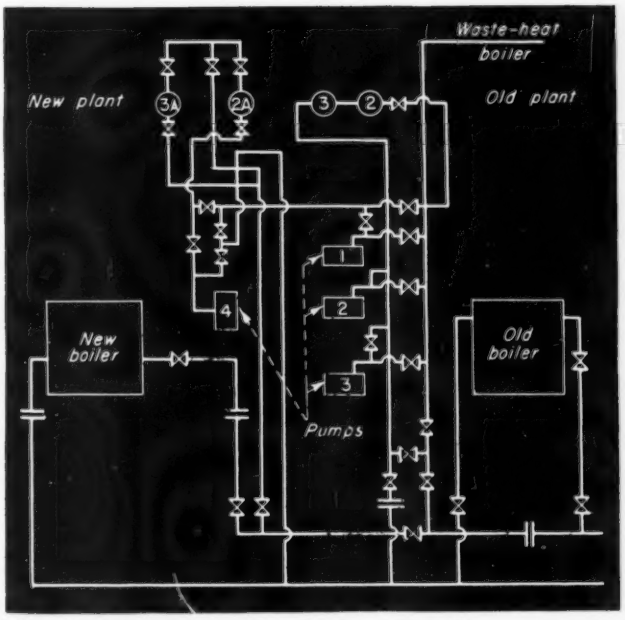


Fig. 2—Boiler-feed-pump piping connections carry the theme of high flexibility, designed into plant extension

New Plant Ties Into Old One Without Interruption

To handle continued load growth after war's end, extension is designed as separate plant under same roof as old units. Hookup insures maximum flexibility with units interconnected

▶ TYING ONE COMPLETE POWER PLANT into a second one, already operating, requires good planning, good load scheduling. The National Lead Co, Titanium Pigment Div, at Sayreville, N. J. licked its heavy demands for steam and electricity by doing just this.

When it became apparent that the 24-hr-a-day seven-days-a-week war load would keep growing for the next few years, J G White Co were called in to design and construct a power plant extension equal to the expected condition. This extension was not to interrupt the already operating plant.

THE PLANT EXTENSION

The requirement of uninterrupted operation resulted in designing a separate plant. This new unit was built under the same roof with its operating elements side by side with the old ones. A design like this gives high flexibility. It allows separate feeds to the different steam headers, permits interchange of feedwater heaters. An example of this flexibility, Fig 2, shows valve arrangement for isolating or tying in boiler feed pumps and heat exchangers.

Steam Cycle. Most major equipment and the general design for this plant extension appear in Fig. 3. A 250,000-lb-per-hr steam generator delivers 400-psi 637-F steam to (1) a 5000-kw impulse-reaction condensing turbine with a double automatic-extraction system (2) a 400-psi process-steam header. The turbine extracts steam at 135 and 30 psi for distribution to process. Steam supply into the 400-psi header receives first priority. Should plant process needs reach such a demand, a bypass would permit delivery of steam to this header without going through the turbine. Reducing valves step this steam down to 135- and 30-psi levels.

Steam for two feedwater heaters, a high-pressure unit at 135 psi and a low-pressure one at 30 psi, comes off these respective headers. The 135-psi unit exhausts to the 30-psi. This, in turn, delivers condensate to a feed-water storage tank. The tank parallels an already present deaerator, which receives (1) makeup from zeolite water softeners (2) condensate from condensers and high-pressure feedwater heaters.

A proportioning type of chemical feed pump delivers sodium sulphite and disodium phosphate to the boiler system at the selected best rate. This rate is set manually. Chemical feed can be either internally applied or introduced in the suction line of the feed pump. Current and favored method at this plant is the internally fed one, which avoids any fouling of heater surfaces.

The turbine condensate pump discharges to the deaerating heater; its suction head is maintained by a re-

circulating hotwell water level control.

Firing System. Fuel for the new steam generator can be coal or oil. Coal, the usual choice, is delivered by barges. It is pulled from a storage pile and fed by a conveyor to an overhead bunker. This bunker, of solid, rigid design, has an acid-resistant concrete lining. It discharges coal onto scales of 200-lb capacity from which fuel enters coal feeders to pulverizers.

These pulverizers—three in number—accept coal and receive primary preheated air for transporting the powdered fuel. They pulverize up to 10,000 lb per hr, and each pulverizer supplies two burners. Electric motors drive these pulverizers through clutch-type couplings to reduce starting-up torque.

With a total of six burners, selection for steam load and individual burner location is a wide one. Burner control for proper combustion forms a part of the air-operated combustion-control.

This system maintains the proper fuel-air ratio by automatically adjusting air flow for changes in steam generation. Steam pressure is maintained automatically by varying coal feed to meet load changes. Furnace draft holds constant by automatic i-d fan regulation.

The fan drives, induced and forced, are steam turbines, with inlet steam admitted through a throttling valve tied into the combustion-control system. This valve regulates speed and hence capacity of the fans. Both receive steam at 400 psi. The forced-draft fan drive exhausts to the 30-psi header, the induced-draft fan to the deaerator. Heat-balance advantages dictated the choice of mechanical drives for these fans.

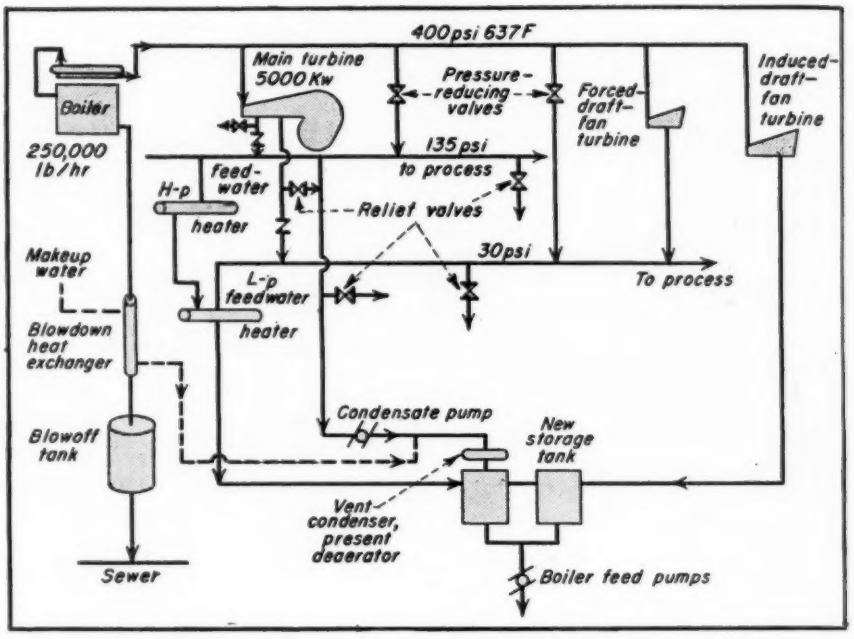


Fig. 3—Major equipment comprising the parallel plant appears in flow diagram. Operating economies dictated mechanical drive for forced and induced fans

Ash Removal. Ash from the combustion within the furnace falls into dry-bottom hoppers. These hoppers tie solidly to the furnace proper and hang suspended, Fig. 5. This suspended construction, in which the hoppers "breathe" with the furnace, eliminates need for a sealing device to prevent air infiltration at the junction point of furnace and hopper. Ash from the furnace hopper is removed hydraulically. This system employs a high-pressure pump for water supply to feed and sluice nozzles. The feed nozzle keeps the ash moving from the furnace ash hopper into the sluiceway. From this passage other nozzles propel the ash to a pond.

Still another form of furnace waste—flyash and dust—that leaves the furnace proper enters a dust collector for final disposal at the ash pond. This collector receives flue gas leaving the

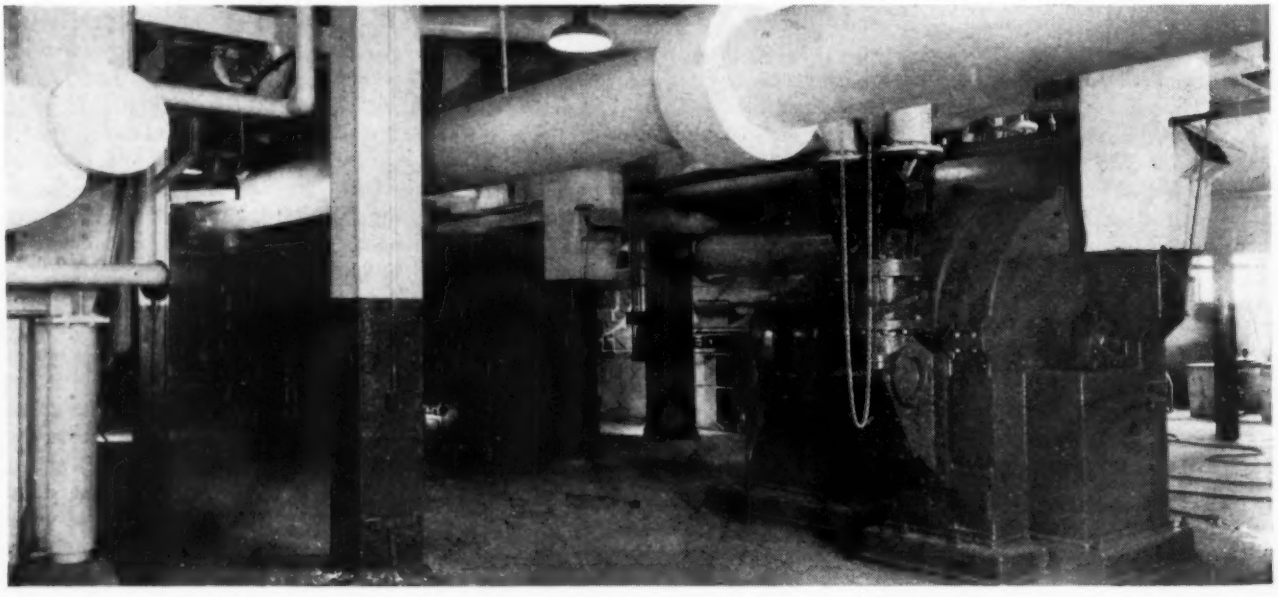


Fig. 4—Three 10,000-lb-per-hr pulverizers supply six burners firing a 250,000-lb-per-hr steam generator in the plant extension. Electric motors drive the pulverizers through clutch-type couplings to reduce starting torque

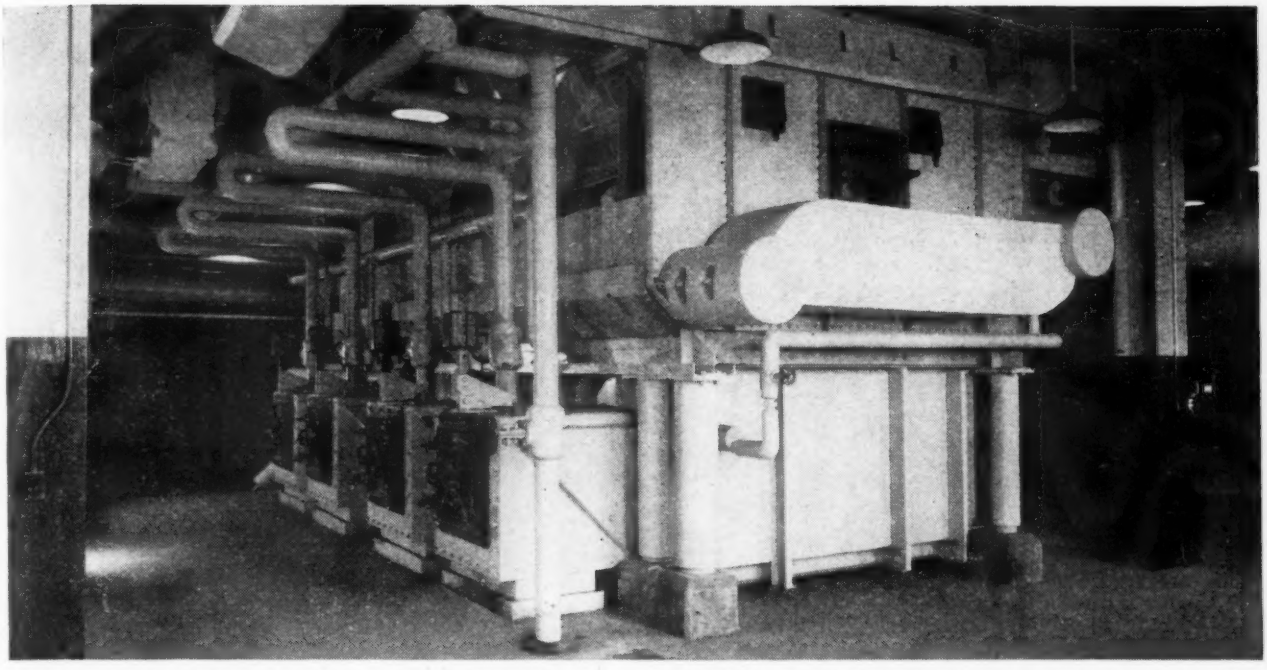


Fig. 5—Dry-bottom furnace of new steam generator has ash hoppers that tie solidly to furnace proper and hang suspended. These hoppers "breathe" with furnace, eliminating need for the air sealing conventionally required

furnace on its way to the stack. It removes 95% of entrained solids of 20 microns (0.00004 in.) in size and over. This removed solid collects in hoppers tied into the dust-removal system. Material leaves these hoppers under the pull of a water-operated jet to be finally discharged into the ash pond. Sluicing water for ash and dust removal comes from the mains for plant service water.

Salt Water. Factory salt-water mains also supply 6500-gpm cooling water at 80 F for the 5000-kw turbine condenser and the 105-gpm for generator air-cooling.

Cut-Over. Upon completion of this separate power plant within the extended housing of an already operating one, all that remained to be done was to cross over from the old to the new and cut in the load. Adequate crossover valves and a flexible design eased this transition. Only one process line, the 30-psi one, required any special handling. That handling involved a temporary shutdown of this header to make the necessary piping connections.

PRINCIPAL POWER PLANT EQUIPMENT

Titanium Div, National Lead Co, Plant Extension, Sayreville, N. J.

GENERATING EQUIPMENT:

Turbine-generator, 1 ..... Westinghouse Electric Corp
5000 kw: double automatic extraction, 135 psi, 30 psi, 3600 rpm, 2400 v, 400 psi, 637 F steam, exhausts at 2.5 in. Hg
Turbine exciter, 1 ..... Westinghouse Electric Corp
125 v, 40 kw, 3600 rpm
Reactors, 3 ..... General Electric Co.
60 cycle, 3 phase, 2300 v, 5% reactive drop on 3000 kva, 120 kva continuous
Condenser, 1 ..... Westinghouse Electric Corp
5500 sq ft, 2 pass, surface type
Air ejector, 1 ..... Westinghouse Electric Corp
Twin element, 2 stage, 270 lb per hr at 150 psi, 625 F
Generator-air cooler, 1 ..... Westinghouse Electric Corp
1600 sq ft, 12,500 cfm air, 105-gpm salt-water cooling
Salt-water strainer, 1 ..... Elliott Co
Twin strainer on air-cooler line
Extraction relief valves, 2 ..... Atwood & Morrill Co
Extraction-nonreturn valves, 2 ..... Atwood & Morrill Co
Turbine switchboard instruments ..... Westinghouse Electric Corp

BOILERS AND AUXILIARY EQUIPMENT:

Boiler, 1 ..... Riley Stoker Corp
2 drum, 250,000 lb per hr, 400 psi, 637 F
Superheater, 1, combined radiation and convection ..... Riley Stoker Corp
2450 sq ft
Pulverizers, 3 ..... Riley Stoker Corp
10,000 lb per hr, attrition type, 85% fineness, 870 rpm
Pulverizer motors, 3 ..... Allis-Chalmers Mfg Co
440 v, 125 hp
Pulverizer coupling, 3 ..... Washburn Shops Div
Rawson lead shoe clutch-type coupling
Induced-draft fans, 2, speed control ..... Green Fuel Economizer Co, Inc
Forced-draft fans, 2, speed control ..... Green Fuel Economizer Co, Inc
Induced-draft fan drives, 2 ..... Terry Steam Turbine Co
400-psi, 637 F supply steam, exhaust at 3-psi
Forced-draft fan drives, 2 ..... Terry Steam Turbine Co
400 psi, 637 F supply steam, exhaust at 30 psi, drive through reducing gear
Dust precipitator ..... Western Precipitation Corp
111,000 cfm gas at 400 F
Ash-handling system, 1 ..... Allen-Sherman-Hoff Co
10 gpm for 4 deflector plates, door spray at 40 psi-32 gpm
Dust-removal system, 1 ..... Allen-Sherman-Hoff
Jet evactor, 100 psi, 640 gpm
Combustion control, 1 ..... Hagan Corp
Feedwater heater, 1 ..... Griscom-Russell Co
2 pass, 280 000 lb/hr—600-psi water, 30-psi steam
Feedwater heater, 1 ..... Griscom-Russell Co
2 pass, floating head, 280,000 lb per hr, 600-psi water. 135-psi steam
Blowdown heat exchanger, 1 ..... Henszey Co
214 sq ft, 2-ft horizontal return tubes, 440 psi, 460 F
Compressors, 2 ..... Pennsylvania Pump & Compressor Co
100 psi, 100 cfm, motor driven, carbon-ring type
Water columns, 2 ..... Diamond Power Specialty Corp
Safety valves, 4, 1-3 in., 3-4 in. ..... Consolidated Safety Valve Div
Coal scales, 6 ..... Richardson Scale Co
3 right-hand, 3 left-hand, 200 lb per charge

PUMPS AND WATER HANDLING:

Boiler feed, 1 ..... Ingersoll-Rand Co
544 gpm, 3550 rpm, 237 hp, 4 stage, centrif, 220 F water
Condensate pumps, 2 ..... Westinghouse Electric Corp
2 stage, centrif, 160 gpm 1160 rpm
Sump pump, vertical submerged, flexible coupling ..... Chicago Pump Co
Feedwater storage tank ..... Tippett & Wood
3 to 5 psi, 9 ft dia x 12 ft, welded steel
Chemical feeder pump, manually adjusted ..... Hills-McCanna Co

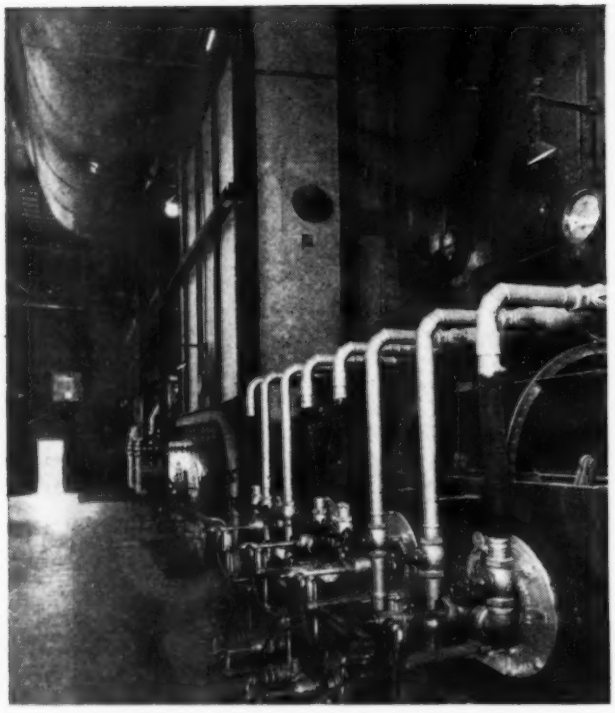


Fig. 1—Boiler No. 3 (light-colored walls) in municipal plant of Springfield, Mo., has 3 to 6% lower boiler losses

Fig. 2—Boiler No. 2, before rebuilding, had cracked and warped side walls as well as warping of steel casing

Rebuilding Boiler Setting Improves Performance, Reduces Maintenance

Operating experience extending over five-year period shows a marked reduction in repair requirements for sectionally-suspended boiler wall compared with solid masonry. The new wall produced a notable improvement in stack temperature and CO_2

By J G THORPE, *Superintendent, Electric Department, City Utilities of Springfield, Mo.*

▶ ALL THE BOILERS in the electric generating plant in Springfield, Mo, installed prior to 1941 had solid-masonry settings. A new boiler, No. 4, that started operation in November 1941, was equipped with a sectionally supported setting. From the start, stack temperatures were lower and the CO_2 higher in No. 4 than it was possible to obtain in the three older boilers. Besides maintaining this improved performance over the succeeding months practically no repairs were required.

By contrast, the old boilers were constantly demanding brick patching, and they had been patched so often that the resulting expansion was forcing the steel work out of alignment. Outlet gas temperatures varied and the fireman could not maintain the correct CO_2 because of air leaks in the setting. Performance of the new unit was so much better that it was decided to install sectionally-supported furnace walls on the old boilers similar to those on No. 4.

Boiler Rebuilding. Wartime restrictions hindered the reconstruction program. While improvements were held up by the war, plans for selling the Springfield Gas and Electric Co were being formulated by the Federal Light and Traction Co. After extensive negotiations, the City of Springfield, Mo, bought the properties, taking possession March 23, 1945.

On March 20, 1946, No. 3 boiler was

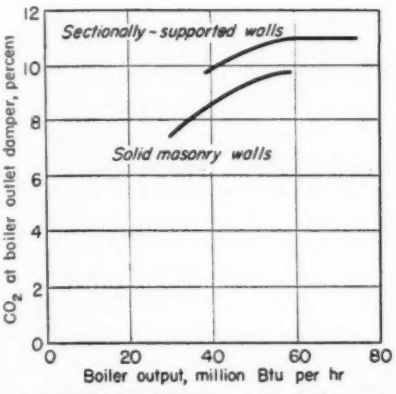


Fig. 3—New boiler walls help raise combustion efficiency and the CO_2

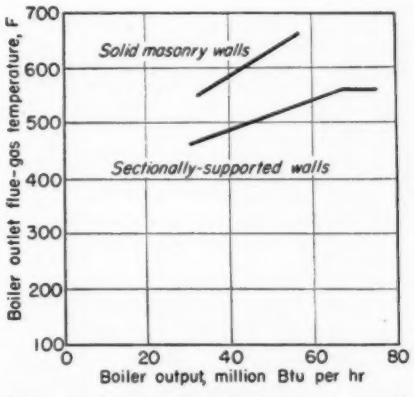

Solid masonry walls
Sectionally-supported walls
Boiler outlet flue-gas temperature, F
Boiler output, million Btu per hr

Fig. 4—Increased efficiency is indicated by drop in gas temperature

taken off the line for rebuilding. The unit came back into service on May 31st after the drying-out fire had run a four-day period. Operating with the new walls, the flue-gas temperature averaged 100 F lower and the CO_2 was about 1.5% higher than with the solid-masonry setting at comparable loads, Fig. 3 and 4. Also boiler losses were 3 to 6% less with the new walls.

In addition to these thermal advantages, the maximum continuous steaming rate was raised by 25%. Furthermore, it became possible to operate the boiler over more widely fluctuating loads with lower stack temperature and higher CO_2. It has been possible to develop 100 million Btu per hr output on peak-load service with the new furnace.

At the time the new sectionally supported heat enclosure was installed, the boiler was rebaffled with Enco baffles. This resulted in the gas-pressure drop through the boiler being reduced over 50%. Where formerly at 57-million-Btu-per-hr output the draft loss between firebox and uptake was 0.25 in. water, the drop now at 59-million-Btu-per-hr output with new baffles is only 0.10 in.

Based on 5½ years operating experience with comparable walls on No. 4, the new furnace installation on No. 3 should insure much longer runs before maintenance becomes necessary. Records for the solid-masonry installations on boilers No. 1, 2 and 3 from Jan. 1, 1944 through Jan. 1, 1946 show eight furnace repair jobs on the three boilers during this period. This is an average of a shutdown every nine months per boiler for furnace maintenance. Between Nov 1941 and July 30, 1946, it was only necessary to shut down No. 4 once for repairs to the furnace walls. This maintenance was caused by a tube failure in the rear water wall, spraying water on the rear furnace wall and spalling furnace refractories.

Each shutdown for solid-masonry repair required the boiler to be out of service from one to three weeks with an average cost of $600 to $1000 per shutdown for labor and material.

Boiler No. 2 has now also been converted with Reintjes sectionally supported walls like those of No. 3 and No. 4 to gain the advantages of higher efficiency and lower maintenance.

Quick Starting Lowers Turbine Heat Stress

▶ FACED WITH THE PROBLEM of shutting down 35 turbines each night and starting them the next morning, the Consolidated Edison Co of N Y, Inc took steps to simplify this procedure. The results of their investigation are recorded in a paper "Quick Starting of High-Pressure Steam-Turbine Units" by J C Falkner, R S Williams and R H Hare, presented before the summer meeting of the ASME at Chicago, Ill, June 16-19, 1947.

For many years, this company started turbines in the conventional manner prescribed by the turbine manufacturers, requiring about 90 to 120 minutes to place a unit on the line. These instructions stress the importance of not allowing rapid temperature changes in the turbine. The quick-starting idea is based on admitting steam to the turbine at a temperature corresponding to that of the main parts of the turbine, such as valve chest, flanged joints, casing. bleed points and exhaust after a shutdown period up to ten hours duration as a maximum limit.

Data collected during normal starts showed the boiler pressure reduced to 200 to 400 psig at the beginning of the rolling period and gradually raised to about 800 psig at the time the turbine was up to speed. Normal operating pressure is 1200 psig. Steam chests at the start were at 650 to 700 F and were actually cooled 50 to 120 F during the first hour of the rolling period because of the low initial steam temperature and the long roll. When the unit was synchronized, the steam-chest temperatures were about the same as at the start of the rolling period.

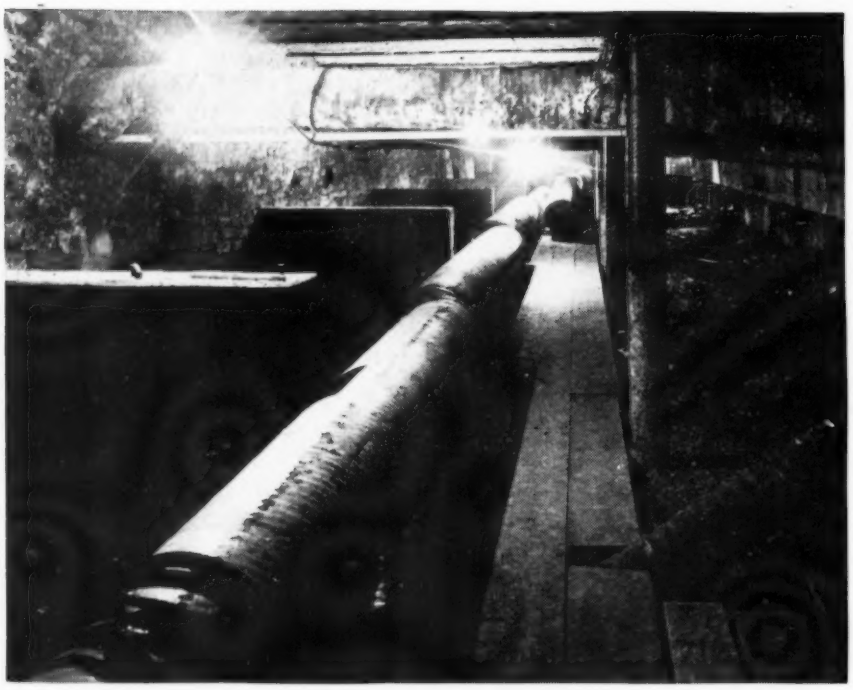
Quick Starting. Based on maintaining minimum temperature differences between turbine and entering steam, the quick startup was developed. The boiler is bottled up by closing the induced-draft-fan vanes, boiler stop valves, superheater and line drains, so that after a 6- to 7-hour outage, boiler pressure is about 850 psig. At low flows, the steam temperature can be controlled by varying the excess air. Heat is thus held in the boiler and eliminates the cooling effect on the turbine by rolling it with steam at a temperature about equal that of the metal in the turbine casing. thereby increasing safety of operation.

Quick starts place the turbine on the line in 15 minutes with less temperature variation than the conventional procedure. Vibrations at various points on the turbine are better or the same during quick startup. Difficulty of bringing the unit through the critical speed is completely eliminated.

Quick starting (1) reduces thermal stresses in turbine and boiler (2) reduces fuel cost for idle rolling (3) reduces personnel costs, and (4) gives better available reserve factor.

With the conventional start, high-temperature steam starts a unit that is several hundred degrees cooler, causing a quick expansion of the turbine spindle towards the generator, reducing clearances.

Steam District Heating Companies Face Growing Loads and Rising Costs



Underground section of new 10-in. 650-psig 750-F steam transmission line of the Rochester Gas and Electric Corp before placement and hooking-up. This is installed in an old raceway formerly supplying hydro power to local factories

National District Heating Association at its 38th annual meeting in Atlantic City, N J, reviews methods of member companies in answering the challenge of increased demand by steam consumers and alleviating the problem of skyrocketing costs

▶ THE 38TH ANNUAL MEETING of NDHA presented an extensive program touching upon all phases of central-station steam supply. The general industrial activity pattern in the United States, which is demanding increased supplies from all types of service industries, is being reflected to a degree in increasing requests for district-heating service. Other factors contributing to this growth are increasing operating and fuel costs of isolated heating plants. Steam sales are estimated at 107% of 1946 output, an appreciable gain, but not an outstanding one. Load growth is undoubtedly being hampered by the small number of new buildings being erected and, in some instances, by lack of new steaming capacity available.

Considerable discussion centered about means of licking the principal bane of central heating, namely, low load factor, which contributes to high investment carrying charges. Of 50 companies reporting results for 1946, 5 had annual load factors between 15 and 19.9%; 28 between 20 and 29.9%; 16 between 30 and 39.9%, and one had 43%. Because of the few hours that a large percentage of the capacity is needed to carry the peak, it was suggested that extremely simple boiler designs might be utilized to bring down investment cost, even at the expense of low efficiency. Evaluations of these designs must necessarily be made for individual systems. It was pointed out, however, that in many instances it would pay to take care of increased steam demand by installing a high-efficiency boiler to supply the base of the load curve, letting existing low-efficiency boilers carry the peak.

Another method of attack would be through promotional work, securing loads that would come on the systems at other times than the heating season. The most promising load is air conditioning which falls completely out of peak-load season. Air-conditioning systems utilizing steam for their energy source fall into several types: (1) absorption (2) steam jet (3) steam-turbine-driven compressor, and (4) steam-engine-driven compressor. The last two are further subdivided as condensing, atmospheric exhaust and back pressure. Selection of particular type would be dependent on an economic evaluation plus consideration of plant capacity, nature of load, load duration and space.

An extensive report was read on experiences with various types of packing for slip-type expansion joints; these were divided in classes: (1) woven duck and rubber (2) asbestos rope (3) asbestos ring (4) plastic packing with gland-packed expansion joints, and (5) plastic packing with gun-packed expansion joints. Lubrication seems to have beneficial effects on packing life.

Details were given on a new 10-in. 650-psig 750-F steam transmission line, over 5000 ft long, that was placed in operation during November, 1946 in Rochester, N. Y. When operating at rated capacity of 220,000 lb per hr, it is expected the steam-pressure drop will reach 400 psig. The line supplies district-heating steam from one of the electric generating plants of the Rochester Gas and Electric Co. This line construction was found to be more economical than installation of a new boiler.

Experiments on cantonment heating installations to prevent steam corrosion were described. Use of amines—cyclohexamine, benzylamine, morpholine—for chemical treatment of the steam will be available soon in a Bureau of Mines bulletin.

A Farm Boy with Mechanical Leanings

ALBERT L COLE

Chose his life work early, followed it closely through many phases. His experience highlights the value of building a broad background first, then specializing along lines of major interest

ALBERT L COLE ponders the next move in power-plant and transmission-line extensions in his Saskatchewan office

▶ "INTO WORK OVER MY HEAD" is the expression A L Cole uses to describe his position at the moment. But this superintendent of power for the Saskatchewan Power Commission in Canada has been in this position most of his life.

As a farm boy in Huron County, Ontario, he started out with a strong dislike for farm chores and an intense liking for machinery—a combination that has sparked many a success. Because of this dislike, his family kept after him with the admonition that he would never amount to a "hill of beans."

During his high-school term, A L roomed with a young engineer of the local electric light plant. It was this association which prompted him to select power-plant work as a career. By taking extra courses in mechanical drawing and mathematics, Cole prepared himself for drafting work. When his school days were over, he was able to get a drafting room job with the Weston Instrument Corp, Newark, N. J.

For an $8.95 weekly pay check, Cole drew up electrical instruments, designed cams for automatic screw machines, and punch and dies for small sub presses. He recalls that one of Weston's prerequisites for a successful draftsman was the ability to split a hundredth of an inch with a lead pencil. He also remembers with amusement, the late Dr Weston sitting at his drawing board with a magnifying glass in his eye, remarking "Not too bad, not out more than five ten-thousandths."

FIRST POWER-PLANT WORK

A L left after two years to act as an assistant on a 1½ year building program at Rainy River, Ontario, involving a steam power plant, distribution system and interior plant wiring.

From there he moved on to an operating engineer's spot with the Light and Power Dept, Regina, Saskatchewan. At this post he rose to chief engineer.

Toward the end of 1921, A L felt that future promotions within the local utility were remote. So he decided to go to New York, arriving in January, 1922. Here Cole had the opportunity of joining the POWER staff, replacing W O Rogers who had taken over as editor-in-chief of the Southern Power Journal. As an editor, he was assigned the task of following the development of the recently-introduced art of burning pulverized coal. He witnessed many experiments on various equipment and furnace designs. Ten years of such close observation built up a fund of information on the latest power-plant practices and designs.

In 1932, Cole went back to the City Light and Power Dept at Regina as an efficiency and betterment engineer.

By 1937, he joined the Saskatchewan Power Commission as superintendent of the steam plant at Saskatoon. This plant had a 140,000 lb per hr, 400-psi, 800 F steam generator added to its capacity in 1939. The following year a contract was let for a 15,000-kw, 13,800 volt turbine generator whose delivery was held up by the war until 1946.

During these years (1937-1946) Cole acted in an advisory capacity on plant extensions throughout the system in addition to his responsibilities at Saskatoon. In July 1946, he became general supervisor of operation and engineering in all plants, steam and diesel.

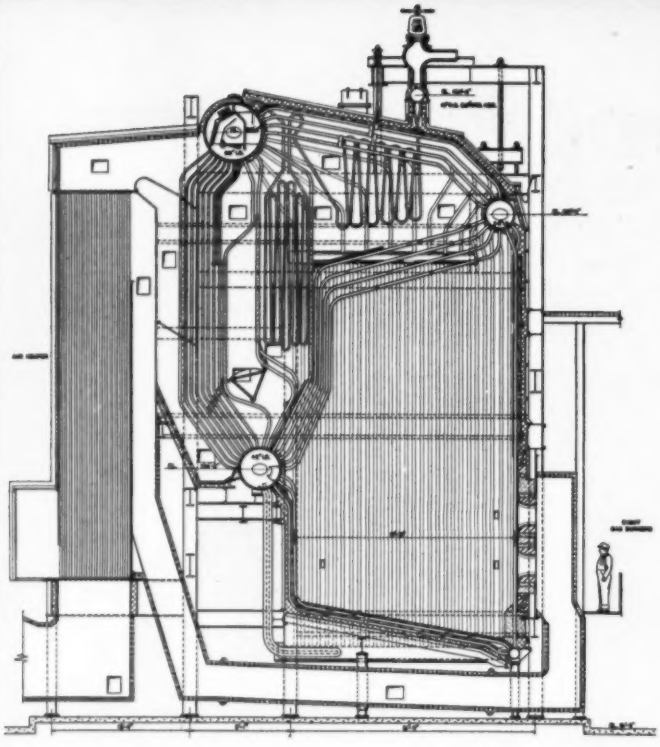
The system now comprises five steam plants of 65,000-kw capacity and 31 diesel plants of 30,000 hp supplying a network feeding five cities and over 300 towns and villages.

Three of the steam plants in the system burn a sub-bituminous coal of 9000 Btu, with 17 per cent moisture and 14 per cent ash. The other two employ "bugdust"— a very fine lignite with a moisture content of 35 to 40 per cent, ash of 8 to 10 percent and a calorific value of 7000 Btu. Operation of these plants has established Cole as an authority on the combustion of low grade fuels.

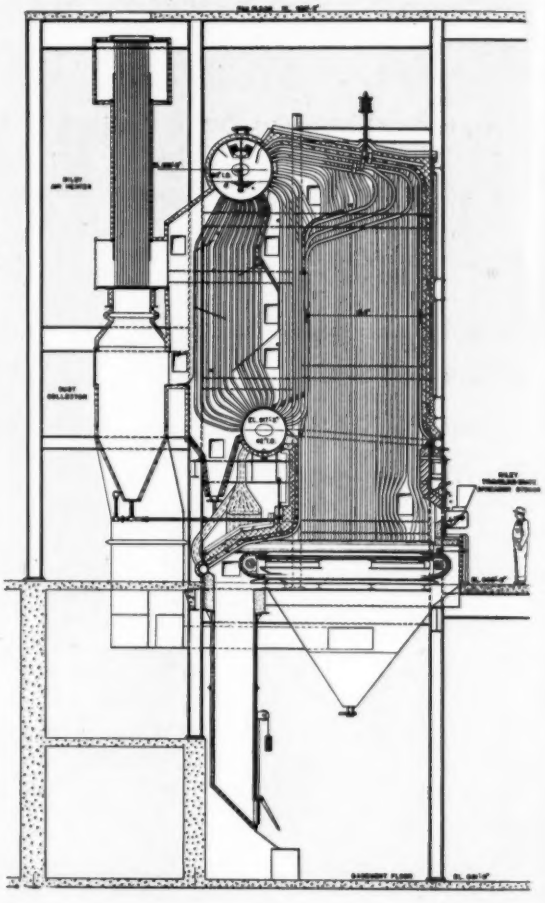
A L's experience as an editor on POWER convinced him that membership in engineering societies is a great help to operating engineers. Today he is a member of the Engineering Institute of Canada and of the Association of Professional Engineers of Saskatchewan. He was formerly a member of the ASME.

Cole's creed of successful power plant operation is a rigidly scheduled maintenance program coupled with an eternally vigilant operating staff.

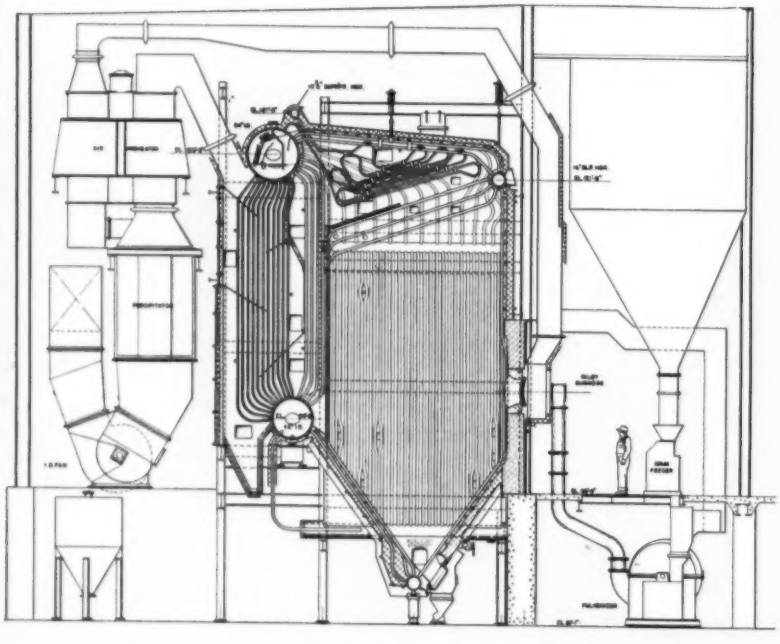
Modern Riley



Southwestern Public Service Co., Borger, Texas
330,000 lbs/hr. Gas and oil fired Riley unit, 1000 lbs. pressure, 900°F. temperature



Ohio Edison Co., Akron, Ohio
(Commonwealth & Southern Corp.)
2 — 90,000 lbs/hr. Riley units fired by Riley Traveling Grate Spreader Stokers, 250 lbs. saturated



Northern Paper Mills, Green Bay, Wisc.
Sargent & Lundy, Engineers
100 lbs/hr. Riley unit. Riley Pulverizers and Burners fired by 700 lbs. pressure, 700°F. temperature

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul Pittsburgh Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

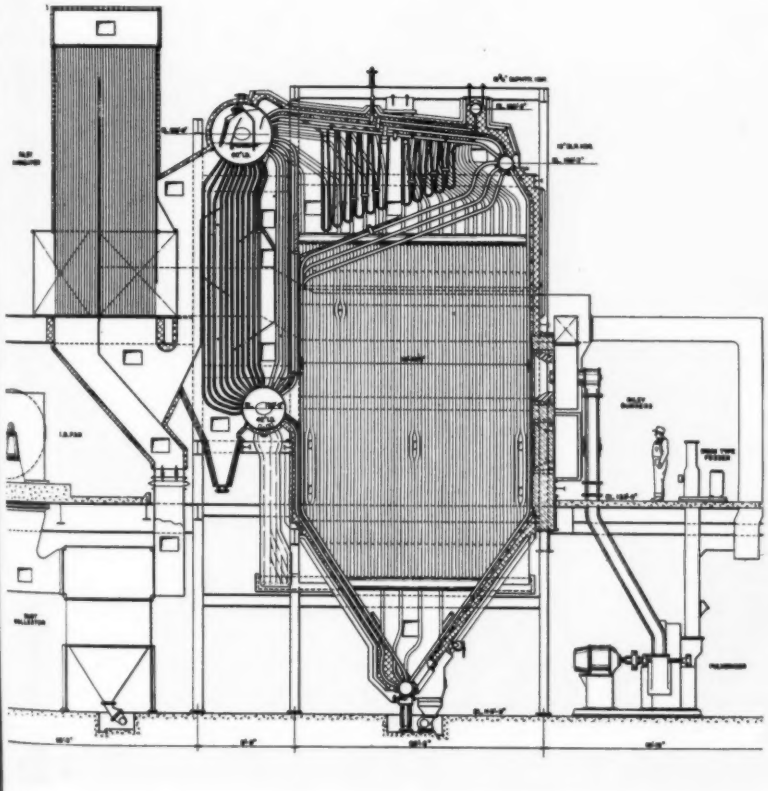
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

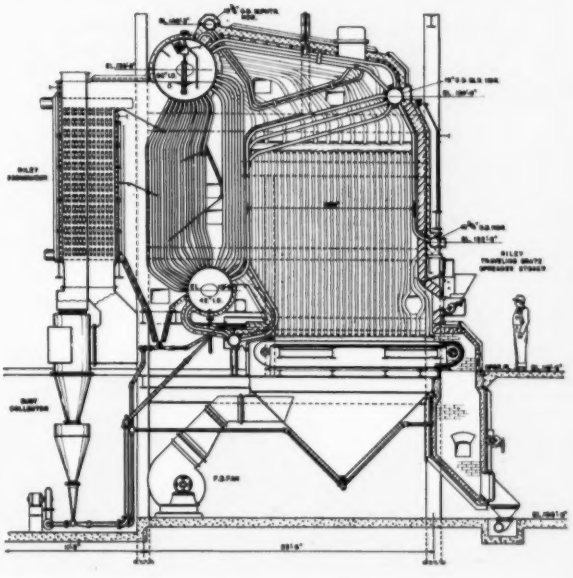
Steam Generating Units

Here are a few recent installations of Riley Steam Generating Units. While the largest unit illustrated is only a 330,000 lbs. per hour unit, Riley sales during the past year, which were by far the largest in Riley history, included many large central station units of capacities up to 825,000 lbs. of steam per hour.

Note that the units for Ohio Edison Company and Utica Knitting Company are fired by Riley Traveling Grate Spreader Stokers. You will be hearing a great deal about Riley Spreader Stokers in the near future. We feel that because of the many outstanding advantages of Riley Spreader Stokers it will pay you to thoroughly investigate them if you are considering this type of equipment.

Riley Steam Generating Units continue to establish records, not only for high efficiency and economy, but for long, continuous, trouble-free operation. Riley has attained a position of leadership in the boiler industry because of the outstanding performance of Riley units—efficiency and capacity guarantees are not only easily met but in almost every case exceeded. Ask a Riley user—he will tell you that you can absolutely "Rely on Riley."





Utica Knitting Co., Utica, N. Y.
Gibbs & Hill, Engineers
2 — 50,000 lbs/hr. Riley units fired by Riley Traveling Grate Spreader Stokers, 400 lbs. pressure, 490°F. temperature

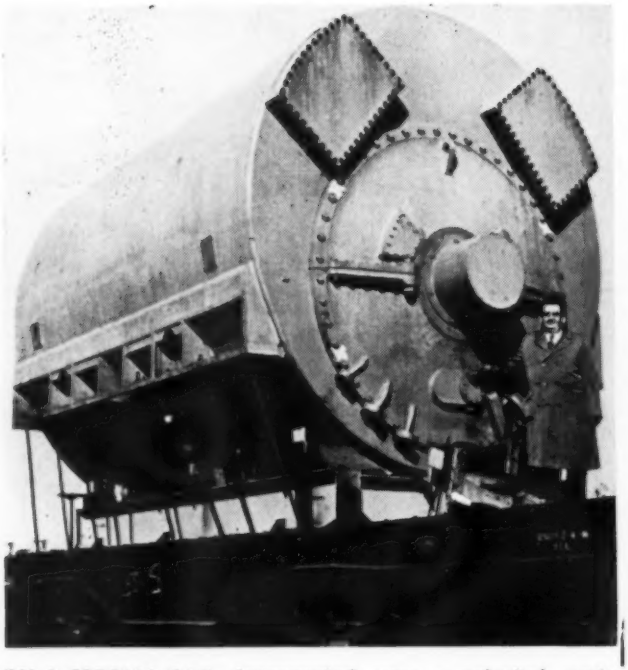
Upper Michigan Power & Light Co.,
Escanaba, Mich.
W. I. Barrows, Engineers
150,000 lbs/hr. Riley unit fired by Riley Pulverizers and Burners, 450 lbs. pressure, 750°F. temperature

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

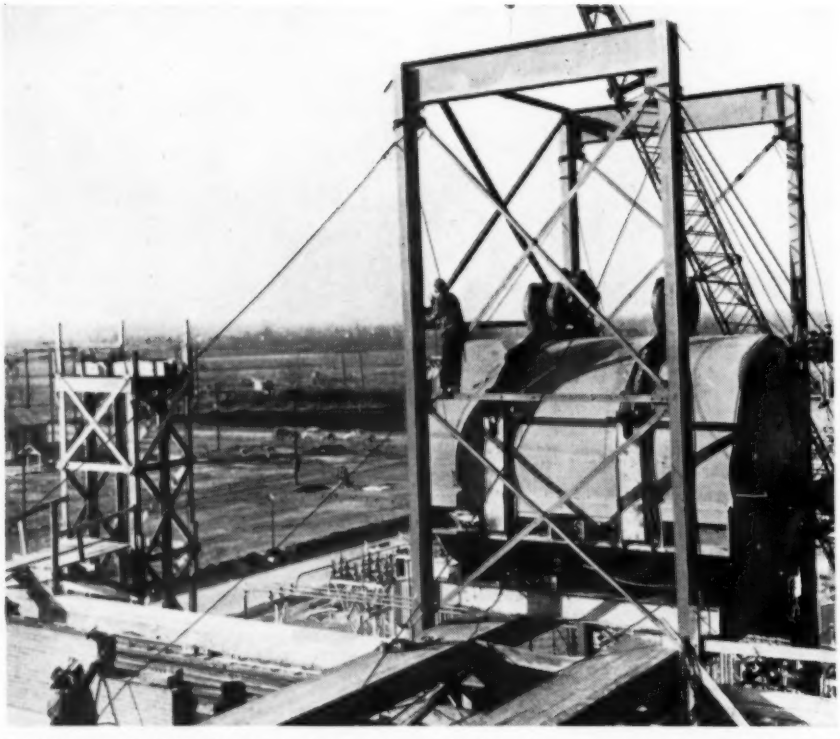
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS



ON A SPECIAL CAR, transported over a selected route, the 30,000-kw Westinghouse generator arrives at the Cecil Lynch station of the Arkansas Power and Light Company

TWO WINCH TRUCKS hoist the 120-ton generator 32 ft to its permanent position on the roof of the power station. Note how timbers brace the trucks to tower base

120-Ton Generator Rises to the Roof



INSIDE SECTION of steel lifting frame had to be removed and rigging dismantled before generator could be moved from this position onto building roof. Note the special lifting slings used to support the machine during hoisting

▶ Moving a 30,000-kw 120-ton hydrogen-cooled generator from factory to generating station presented a number of unusual problems to Arkansas Power and Light Co and Westinghouse engineers. The generator had to be installed on the roof of the Cecil Lynch station (near Little Rock, Ark.), 32 feet above the ground. The existing gantry crane could not be used because it did not overhang the building and because of the great weight of the completely assembled generator. Engineers put their heads together and pre-planned each stage of handling the generator from factory to roof-top foundation.

Here's how it was done: The generator was hauled on an 8-axle (16-wheel) flatcar, because its weight imposed unusual railroad restrictions. The route had to be specially mapped out so all bridges were strong enough to support the load and underpasses provided clearance. Traveling speed was restricted to 25 miles per hour, and the machine could be moved only during the daytime. A Westinghouse representative rode with the generator

TWO HOURS WERE NEEDED to raise the generator to its final height because of careful handling. After it reached the top, I-beams were inserted under the sub-frame to support the generator's weight while preparing for the next step

Here's how Arkansas Power and Light engineers solved the problem of raising a 120-ton generator 32 feet to the top of a building. The solution turned out to be simple and workable

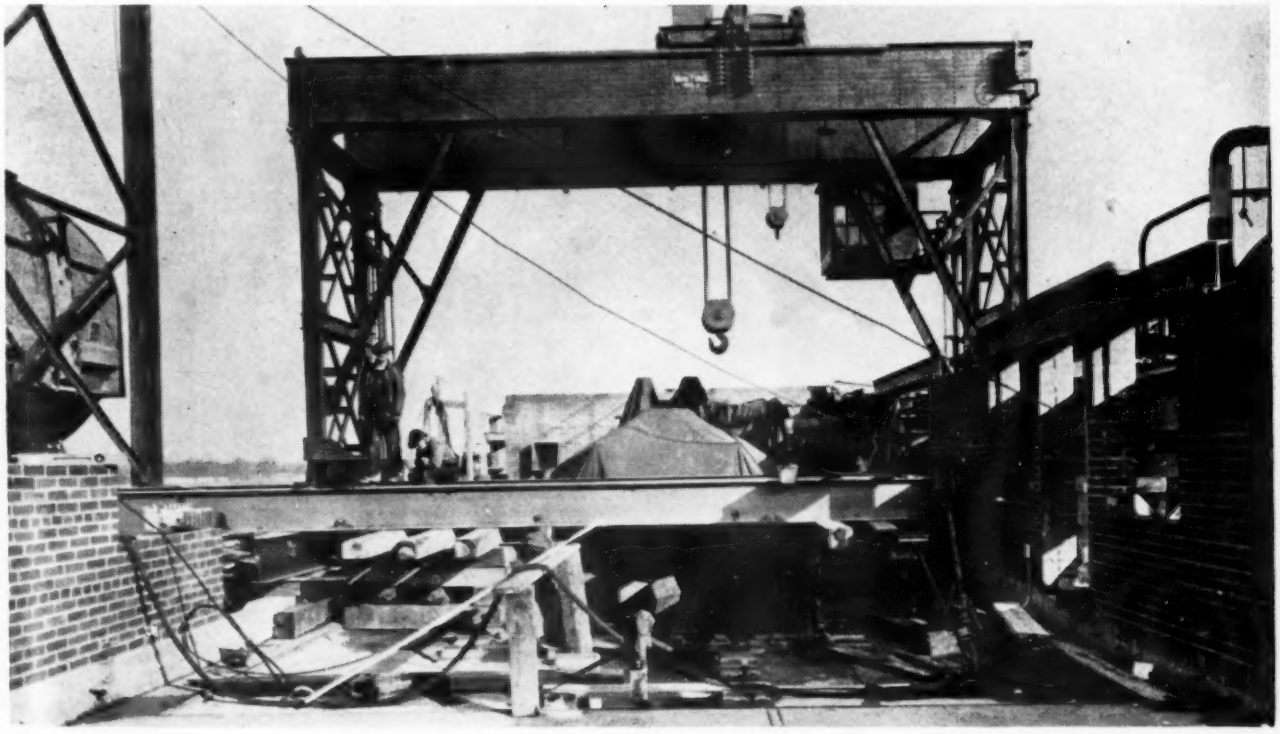
on its trip, which took almost three weeks.

Hoisting Method. To lift the generator, a frame was built against the side of the power plant with two legs resting on the ground and two on top of the wall. Since the legs were too close together for the generator to pass between them, the inside set resting on top of the wall had to be removed after the generator was hoisted to roof level.

Two sets of five-by-five blocks were used to lift the generator. Two winch trucks supplied the power, one for each set of blocks. The trucks were braced against the base of the tower to provide thrust for the trucks and the front ends were also blocked to keep them steady.

Careful handling was required during the lifting process to keep the generator level at all times. It took more than two hours to raise the 120-ton monster to the 32-ft elevation. After the generator was raised to its highest point, two I-beams were inserted below it so it could rest on the tower and building wall while the lifting mechanism and inside section of the tower were removed.

The generator was then skidded along the I-beam until it was over the foundation where it was lowered into place.



WITH TEMPORARY supporting beams in place on wooden cribs, generator is ready to be shifted over foundation and lowered to its final position. Beams are a temporary track for skidding generator over wall onto foundation. Extreme weight of generator makes it too large for the crane; therefore the entire moving operation was done by skidding

HOW TO LASSO

Reduce heat loss, cut fuel bills... *with Armstrong Trapping!*

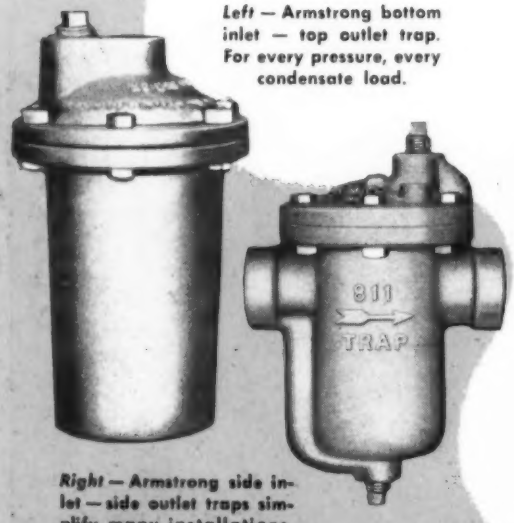
B.T.U.'s have a bad habit of getting away without doing productive work. Most plants combat this with efficient boilers and stokers, scale-prevention chemicals, soot blowers, economizers, insulation, heat exchangers and other equipment. Unfortunately, many of them lose much of the value of this large investment by overlooking one of the most serious sources of heat loss: faulty steam traps or poor trap installation practice. Table B below shows what leaky traps, cracked valves or other devices can cost in terms of wasted steam. But leaks aren't the whole story. Anything that reduces temperatures or heat transfer efficiency in a steam consuming unit wastes steam and fuel. Failure to remove condensate and air will reduce machine temperatures and slow down production. Not only is quality of production decreased, but non-productive radiation losses are increased.

SEE OUR CATALOG IN SWEET'S

Armstrong traps discharge both condensate and air *as fast as they accumulate*, keeping units full of live, dry steam. They don't stick or clog because the condensate swirls through, carrying away dirt and scale. They'll stay on the job a long time with little attention because the hardened chrome steel valve and seat resist wear remarkably. Stainless steel corrosion-resistant working parts complete the picture.

To save B.T.U.'s, install an individual Armstrong trap on each steam consuming unit. For details on prices, capacities, trap selection and installations practice, send for a copy of the Armstrong Steam Trap Book.

ARMSTRONG MACHINE WORKS • 812 Maple St., Three Rivers, Michigan



Left — Armstrong bottom inlet — top outlet trap. For every pressure, every condensate load.

Right — Armstrong side inlet — side outlet traps simplify many installations.

TABLE A. Showing temperature reduction caused by air at various pressures.

Gauge Pressure	Temperature of Steam with No Air Present	Temperature of Steam Mixed with Various Amounts of Air. (Per Cent Air by Volume)		
		Ten Per Cent	Twenty Per Cent	Thirty Per Cent
10.3	240.1	234.3	228.0	220.9
25.3	267.3	261.0	254.1	246.4
50.3	298.0	291.0	283.5	275.1
75.3	320.3	312.9	304.8	295.9
100.3	338.1	330.3	321.8	312.4

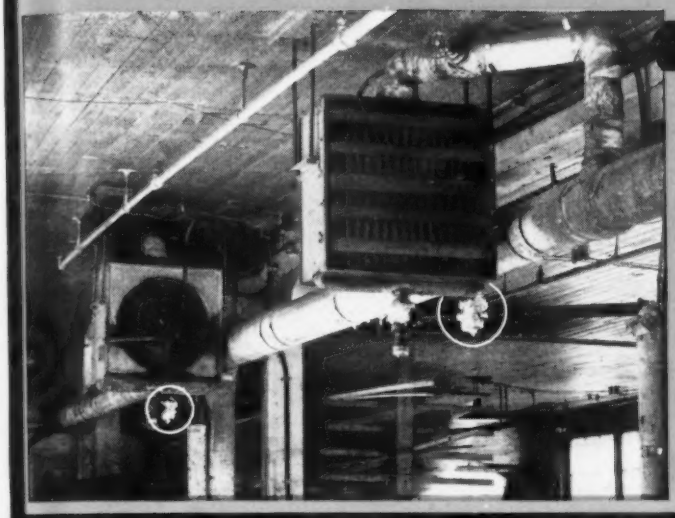
TABLE B. Showing cost of various sized steam leaks at 100 pound pressure. (assuming steam costs 50 cents per 1000 lbs.)

Size of Orifice	Lb. Steam Wasted Per Month	Total Cost Per Month	Total Cost Per Year
1/2"	835,000	$417.50	$5,010.00
3/8"	470,000	235.00	2,820.00
1/4"	210,000	105.00	1,260.00
1/8"	52,500	26.25	315.00
1/16"	13,200	6.60	79.20
1/32"	3,400	1.70	20.40

(For steam at 50 pounds pressure, the waste is about 75% of the above figures; at 20 pounds, it is about 50%; and at 5 pounds, the loss is about 25%.)

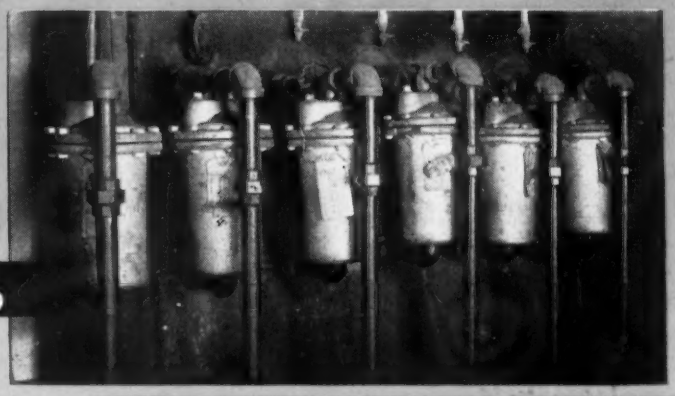
ARMSTRONG *Inverted*

THE B.T.U.



SAVES 170 TONS OF COAL

Armstrong unit trapping of wood kilns and unit heaters at a large Milwaukee firm cut coal consumption from 460 to 290 tons per year, a saving of 37%.

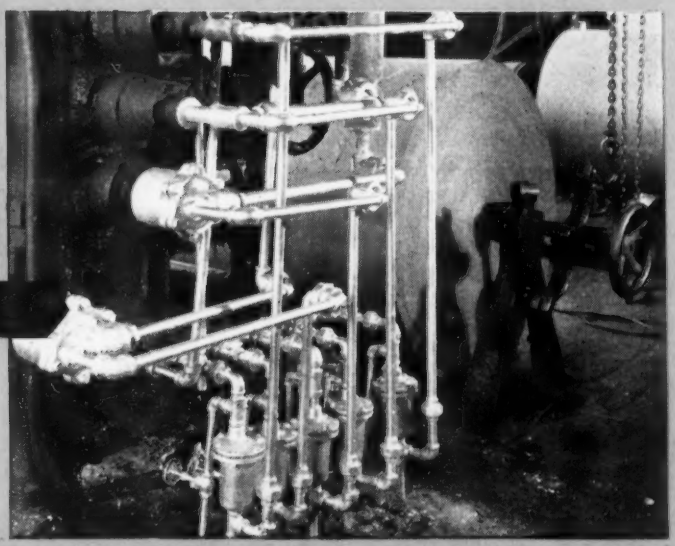


SCHOOL CUTS COAL BILL 50%

Armstrong traps at a Springfield, Ohio, school cut coal consumption in half, eliminated the use of one of two boilers and did away with a gas hot water heater that cost $60 a month to operate.

SAVES 3 CARS OF COAL

In one heating season, a Toledo greenhouse saved $450 on coal by making a $234 investment in Armstrong unit trapping.



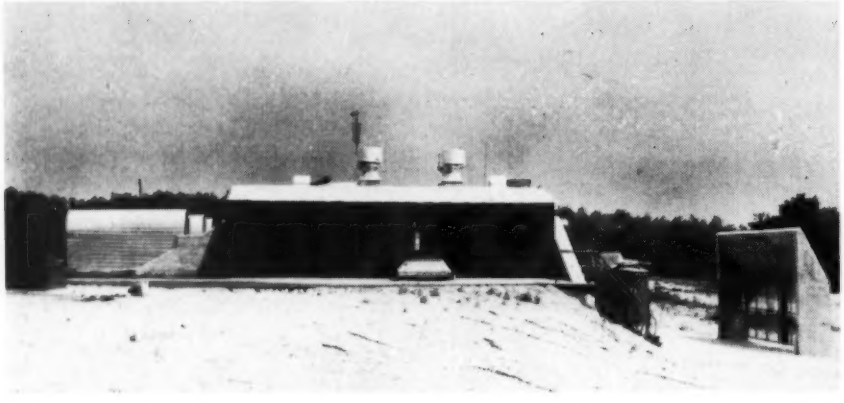
SAVES 20% ON FUEL

Armstrong unit trapping at the plant of a Baltimore paper box manufacturer not only cut fuel consumption 20% but reduced trap maintenance 80% as well!

Bucket STEAM TRAPS

Front end of test pit showing three entrances to two reactant rooms and one control room. Stairs lead to rooms below

"Bombproofs" for Rocket-Motor Tests



Side view of one of three test pits, with entrances at left and rocket-flare deflector at far right. Concrete walls around the motor room are 3-ft thick

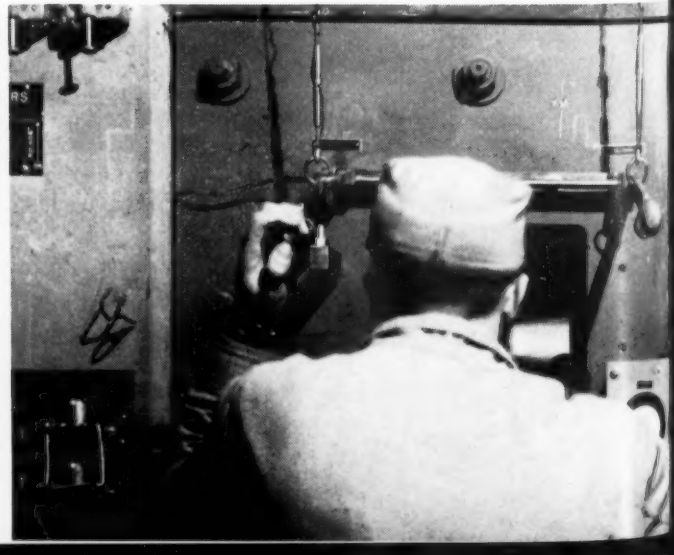
▶ IN ITS BRIEF LIFE, a rocket motor delivers a terrific punch. Such a wallop, in fact, that pits for static-testing these mighty midgets resemble bombproofs. This 3-pit plant near Schenectady, N. Y., can handle motors capable of developing up to 50,000-lb thrust (equivalent to 50,000 hp at about 375 mph).

Each pit consists of: (1) control room (2) motor room, and (3) two reactant rooms. Steel-reinforced concrete walls, 3-ft thick, isolate motor room. Other walls and roof are 2-ft thick.

In operation for about a year, according to Ray Stearns, General Electric Co, this station is part of a long-range rocket-research program pursued jointly by GE and U. S. Army Ordnance.

Removing rocket motor from motor room. Three windows at left connect to control room; camera mounted on wall

Operator in control room watches rocket flare in motor room through observation port during a static-test run



THE RUHR—
VALLEY OF DECISION

FOR AMERICANS and for American business the most important single spot on earth today is the Ruhr Valley of Germany—a valley no bigger in area than the State of Rhode Island. Upon recovery in the Ruhr hinges recovery in Europe. Upon recovery in Europe hinges the peace of the world.

No machine can run with its most important part missing. Western Europe without the Ruhr is a dead machine. Before the war, over half the coal and steel produced in the Western part of Continental Europe came from this one little valley. Today, the fact is that no other region in Europe has the technical skills and enterprise to produce the industrial supplies which Europe must have if it is to help itself back to a self-supporting economy. And, after observing Europe for many weeks, I am convinced that no one but the United States can successfully supervise the rebuilding of the Ruhr.

If you will keep four considerations in mind, as the international politicians gamble, you can easily tell whether the United States is playing its proper role in the rehabilitation of the Ruhr. Here are the four considerations:

I. We are paying for the Ruhr rehabilitation (or the lack of it).

II. We alone have the skill and enterprise to supervise its rebuilding.

III. It will be a tough organizing job requiring money, hard work, and outright sacrifice on the part of management men and technicians.

IV. We had better do it well if we love our children.

I

We are paying for rebuilding the Ruhr—or we soon shall be. The British now control the Ruhr, its government and its industry. They have been paying out about four hundred million dollars—American dollars—a year to buy the food, raw materials and equipment needed to rebuild the Ruhr. The British must spend American dollars for these supplies because the supplies can not be bought anywhere but in America. Thus far the British have, in effect, obtained the dollars which they spend for the Ruhr by drawing them out of the $3,750,000,000 loan which we granted Britain last year.

Now the loan is fast running out. The British lack dollars and other assets. We must take over, directly or indirectly, the dollar expenditures for rebuilding the Ruhr. We shall pay for it. Therefore—

II

We should supervise it. The British have been running the Ruhr's industry. They might conceivably suggest to Washington that they continue to run it while we pay the bill. *That we should never agree to.* There is a sound old rule that he who pays the piper shall call the tune.

Perhaps we would not need to invoke that rule if the British had done a good job reviving the industries of the Ruhr. *They have done a poor job—physically and ideologically.*

The physical output of the coal mines and steel mills of the Ruhr in recent months was actually smaller than at the first of the year. Production of coal amounts to little more than half of the pre-war 127 million tons per year. Steel productions limps along at one-sixth of the pre-war rate—far below the volume permitted even under the present low level-of-industry plan for Germany.

Ideologically, the British Labor Government has tried to export to Germany the brand of socialism which is making such a dubious record at home. Foreign Minister Bevin—although he may now have misgivings about it—committed himself to nationalization of the Ruhr's coal and steel industries. British representatives have pushed hard to get General Lucius Clay, our able military governor in Berlin, to agree to socialization of the Ruhr. So far, he has resisted this pressure, but our State and War Departments and we as individuals must back him up to the limit if he is to continue to combat this pressure successfully.

Even if the British government were not socialist, there would be good reason for questioning the ability of Britain to rehabilitate the industries of the Ruhr. In recent generations, the British management class has shown itself more

interested in cartels, restricting output, and allocating markets, than in full-steam, ingenious enterprising production.

Certainly the British must remain full partners in the *political* administration of Germany. No one suggests anything else. However, their recent production record demands turning the job of revitalizing the Ruhr industries over to the nation which is paying the bill and which leads the world in production.

If we have any faith in the business philosophy by which we have lived and prospered for 170 years, we should demonstrate that that philosophy still is dynamic by taking up the burden of the Ruhr.

III

It will be a tough job. It will require men and supplies and money from the United States. It can not possibly be done in less than five years. A list of some of the necessary steps shows how hard it will be.

A. Plans for socializing the Ruhr should be shelved quickly. The industries there should remain in trusteeship for five years. Then the Germans themselves should decide their ownership; let us hope that by that time we can demonstrate to them that private ownership and private initiative mean high production, good distribution and high wages.

B. The top supervising management jobs—both the top policy and the top technical jobs—required outstanding business ability. That is why American business men must be willing to go to Germany, sacrificing comfort and leisure, and even income, if necessary.

C. Germans should take over the management job at the operating level. The Germans are good technicians. They have a greater incentive than anyone else for getting the Ruhr back in working order. That incentive should be harnessed.

D. Special effort should earn special rewards. There is nothing wrong with the Ruhr (or the rest of Europe) that hard work will not cure. Before a man will work hard, he must feel that his work will advance him and his family. That simple motive, which powers our whole economy, must be revived in the Ruhr. To revive it requires enormous ingenuity and work... a new currency... a logical customs union... a sensible ration system... enough food, clothing, housing and consumer goods so that the worker can buy something with his currency and his ration points.

E. America will have to furnish a good share of these foodstuffs and supplies. Certain key items of equipment also will be needed. Only as we succeed in our job can this flow be diminished.

F. A sensible priorities system must channel Ruhr coal and steel into those uses which, in turn, will further increase output. Repair parts for railroad cars should stand high on the list. Housing, coal equipment and machine tool parts should come ahead of the automobiles and permanent steel bridges which at times have been accorded preference.

German technical management of industry in the Ruhr—point C above—need not mean *political* control of the Ruhr by some future sovereign German state. As the French know, the Ruhr, next to the atomic bomb, is the most dangerous weapon in the world. It is the arsenal without which no European power, even Russia, would dare start a war. There is no sense in turning that arsenal back to the *political* control of a nation which twice in 25 years used it for aggression. (And three times since 1870.) Surely we have enough resourcefulness to let the Germans who live in the Ruhr run the industries there without turning political control over to a central Prussian state.

This partial list shows how much hard work and statesmanship the United States must put into the Ruhr. But—

IV

We had better do it if we love our children. If we do not do this job—if we should pull out of Germany or fail there—we leave behind us a vacuum which neither Britain or France has the strength or ability to fill. Russia has the will and if left unopposed, the power to fill that vacuum. Therefore, the day we fail or the day we pull out of Germany, the third world war takes a long step closer to us and certainly to our children. What greater incentive does any American need to work for than our success in this field?

If we succeed, the western zones of Germany in conjunction with Belgium and Holland can become self-supporting in three to five years. That way lies recovery for all Europe. That way lies peace for the world. That way lies vindication for the American business system in which we believe—the system of competitive private enterprise, with freedom for the individual and his initiative.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

THIS IS THE 60TH OF A SERIES

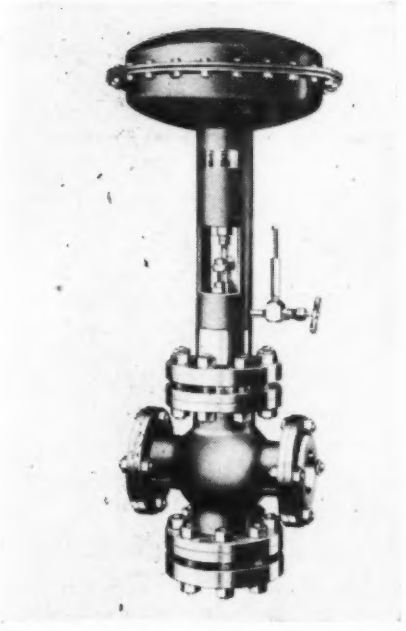


Fig. 1—Valve consists of body, diaphragm, opposing spring, plug, stem

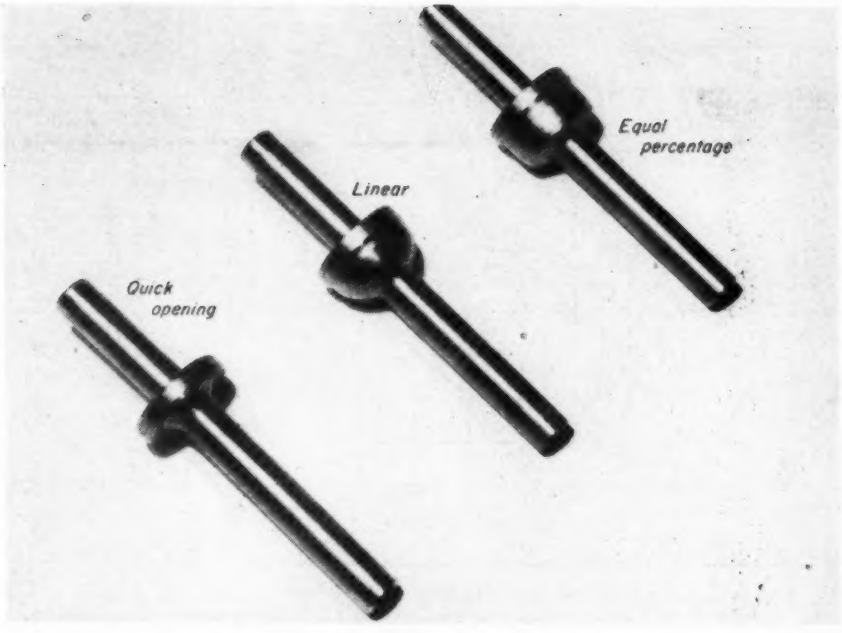


Fig. 2—Three most common valve-plug designs are quick opening, linear, equal percentage. Point is to select the valve plug best suited to do the job

How To Select a Control Valve

There is more to specifying control valves than listing style, size and trim. This article* explains why the valve flow characteristic must be suitable for the job. In two parts: Part I

By **BRUCE A IRWIN**
General Sales Manager
Hammel-Dahl Co

▶ MANY CONTROL-SYSTEM SPECIFICATIONS incorporate numerous details about the instrument such as range, chart drive, sensitivity, accuracy of pilot output, pilot capacity, deviation and hysteresis. And they generally end by stating: "One 4-in. control valve, extra-heavy cast-iron flanged body, stainless-steel trim." Regardless of how well the instrument can measure the condition to be controlled, unless the control valve does exactly what the instrument commands, the installation will be unsatisfactory. Let us, therefore, examine this thing called a diaphragm control valve to see: (1) what it is, (2) how it functions mechanically and (3) what we mean by *valve characteristic.*

Basically, a diaphragm control valve is a means of introducing variable resistance into a fluid flow system. Under low flow conditions, the valve must dissipate energy in the form of pressure drop to give the desired flow rate. When high flow rates are demanded, very little energy is dissipated. Variation in energy absorbed by the control valve is governed by its ability to vary its port area. A definition of a control valve might be: *The means of introducing variable resistance into a fluid flow system* or *An engineered obstruction in a pipe line.*

Mechanically, most control valves consist of a body, and a plug and stem attached to a diaphragm, which is enclosed in a case generally mounted on a spring barrel, Fig. 1. Air loading on the diaphragm is balanced by some external force, generally springs. Variation in air loading pressure from the control instrument causes the diaphragm, stem and plug to move. Thus the valve plug assumes variable positions in relation to its seat in the valve body. For this reason, a control valve can also be defined as a *diaphragm-operated variable orifice.* Using this comparison, remember that the orifice need not be circular in cross section.

The term *control valve* may refer to any of the following diaphragm-operated valves:

1. Single-seated, such as piston, needle, wedge or step cone
2. Double-seated, or balanced, such as parabolic, V-port or annular type
3. Free-flow venturi throat
4. Pressure-balanced
5. Three-way
6. Butterfly 30-, 60- and 90-deg and V-port
7. Saunders Patent (Hills-McCanna)

A control valve has two basic types of action: *air-to-open* and *air-to-close.* In former years, the terms direct and reverse-acting were used, but because of diametrically opposite use by various manufacturers, they have been largely dropped. With most valves, a pressure variation of 0-15 psi applied to the diaphragm full strokes the valve, although

* *Abstract of a paper delivered before the first regional conference of the Instrument Society of America, Detroit, April 4, 1946.*

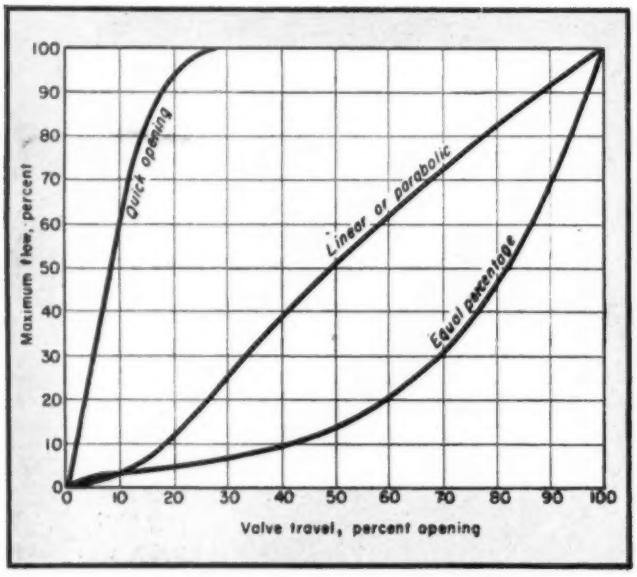


Fig. 3—Individual characteristic curves plotted on uniform coordinate paper compare the flow-travel relation of quick-opening, linear and equal-percentage control valves

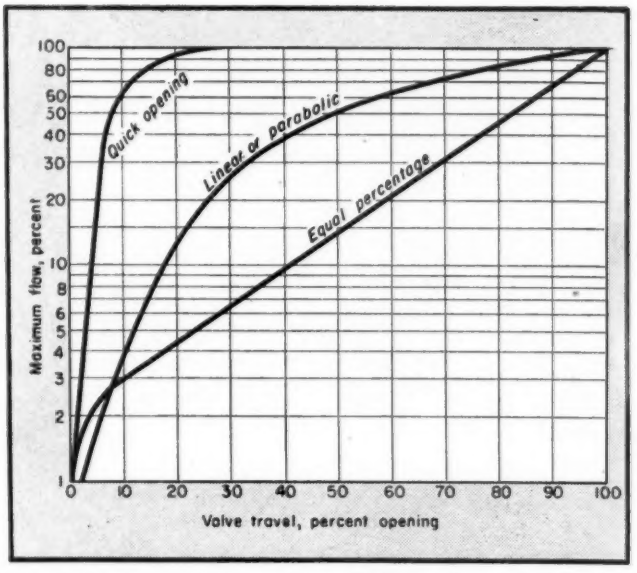


Fig. 4—Use of semi-log paper divides flow scale into two sections and opens the low-flow area for more accuracy. Slope of the curves indicates rate of flow change

in practical operation the variation runs about 2-14 psi to insure: (1) definite spring closing in the air-to-open type, and (2) that the 15-psi output of the controller tightly closes or completely opens the valves. Actually, the spring range of the diaphragm control valve must match the instrument pilot range.

While the more usual range of valve loading pressure is 0-15 psi, some manufacturers use a 0-25-psi range. Regardless of the range, a diaphragm valve is supposed to position its plug in a definite reproducible position for a given loading pressure sent from the control instrument. Also it should respond to the most minute change in output pressure from the instrument.

In general, the three most common valve-plug designs are: (1) quick opening, (2) linear (parabolic) and (3) equal percentage or logarithmic, Fig. 2. These solid plugs operate on an annular basis, although the same characteristics could be equally well produced by a V-port plug or several other types of construction. Control-valve characteristic, briefly stated, is—*how the valve acts.*

In the beginning, control valves were made with quick-opening or bevel-seated plugs, single or, preferably, double-seated. The lift was generally 1/4 D—D being the seat diameter. Valve lift was arrived at by dividing the seat areas by the seat perimeter giving the maximum useful lift of D/4. The flow curve generated is a straight line at constant pressure drop through most of the travel.

Thirty years ago, it appeared easier to control flow by increasing valve lift. Consequently, a double-seated skirted-type plug with four equilateral triangular ports in each skirt was manufactured. While the word "V-port" describes the construction accurately, the valve-port area as a lift relationship actually produces a parabolic curve. The lift is generally several times that of bevel-seated plugs.

About fifteen years ago, the solid-type parabolic plug was introduced. The plug contour and flow behavior produced at that time can be accurately described as parabolic. Valve lift was several times that of a bevel-seated plug, but generally less than a V-port.

EQUAL-PERCENTAGE VALVE

Present-day thinking is about evenly divided between the parabolic (linear) flow curve and the equal percentage (logarithmic) flow curve. Both types have distinctive characteristics and advantages. Let us first define each characteristic and then explain its application in general terms.

"A control valve with a parabolic (linear) flow characteristic produces constant unit change in flow for a unit change in lift at constant-pressure drop." This type of characteristic is needed where pressure drop in the system is largely concentrated across the control valve and most of the energy must be dissipated by it. The parabolic (linear) characteristic should also be used when ultimate maximum capacity of the valve body is required.

"A control valve with an equal percentage (logarithmic) flow characteristic produces constant rate of change in flow for a unit change in lift at constant-pressure drop." Change in flow is always proportional to the flow rate, just before the change was made, regardless of whether it is an increase or decrease.

The equal percentage (logarithmic) characteristic should be used where most pressure drop or energy is *normally* absorbed by the system with only a small proportion concentrated across the control valve, yet under low flow rates practically all the pressure drop may be concentrated at the valve. Even with variable flow and pressure drop this characteristic provides uniformly satisfactory control at any point of lift in excess of clearance leakage. This type characteristic should be selected when operating conditions cannot be determined and it is necessary to install a line-size valve.

Fig. 3 is a characteristic plot on uniform coordinates of a quick-opening plug, a parabolic or linear plug, and an equal-percentage valve plug. The quick-opening plug generates a straight line for about 70% and its travel is only 30% of the other types. This type is satisfactory with constant pressure drops or on open-and-shut service. The parabolic or linear-valve plug gives about 50% capacity at 50% opening. Equal-percentage plug gives about 13 to 15% capacity at 50% lift. Actual lift in inches of the parabolic and equal-percentage curves is several times that of the linear plug.

Fig. 4 shows exactly the same information as Fig. 3 except that semi-logarithmic paper is used. Valve travel in percent opening has the same uniform coordinates but percent of maximum flow is plotted on a logarithmic scale of two cycles: the first from 1 to 10; the second from 10 to 100. Inasmuch as the equal percentage characteristic is *logarithmic* it plots as a straight line on this paper, just as the parabolic or *linear* characteristic plots a straight line on linear paper.

Data on both linear and semi-logarithmic plots are informative but still only qualitative. To present quantitative information on valve lift and flow, definition of a control valve as a *diaphragm-operated variable orifice* suggests the idea of a valve coefficient (C_v) which in terms of flow characteristics, and valve-sizing calculations, is analogous to discharge coefficient C in orifice-metering calculations.

Valve Coefficient An example familiar to all is the practical orifice-meter formula for liquids:

$$Q = C\sqrt{h}$$

where

Q = liquid in gph at 60 F

C = coefficient or quantity of liquid flowing through orifice when water-differential pressure is 1 in.

h = differential in inches of water

This equation is exactly the tool we want for valve work, but the units are not suitable. Valve-flow coefficient (C_v) is therefore defined as the flow of water through a valve at any lift, in gpm at 1.0-psi pressure drop. Although C_v can be calculated for all intermediate positions of plug lift, the values given in this article refer to valve capacity at maximum lift.

The C_v of a given valve is the same for all fluids handled whether liquid, steam or gas. If all flow conditions are known, C_v can be calculated from formulas given next month.

Valve coefficient with the plug at maximum lift (fully open) accurately expresses the actual port area of the valve and is a number that can be used to state the valve's relative capacity. For example, the C_v maximum of a 1-in. valve is 10. The value of 10 (C_v) is always understood to mean gpm flow of water at 1-psi pressure drop. As control valves come in rational sizes above 1 in., max C_v for 2-in. valve is $2^2 \times 10 = 40$; a 4-in., $4^2 \times 10 = 160$.

The principal constructional features, Fig. 5, of a family of five equal-percentage annular plugs, which have consistent flow behavior are:

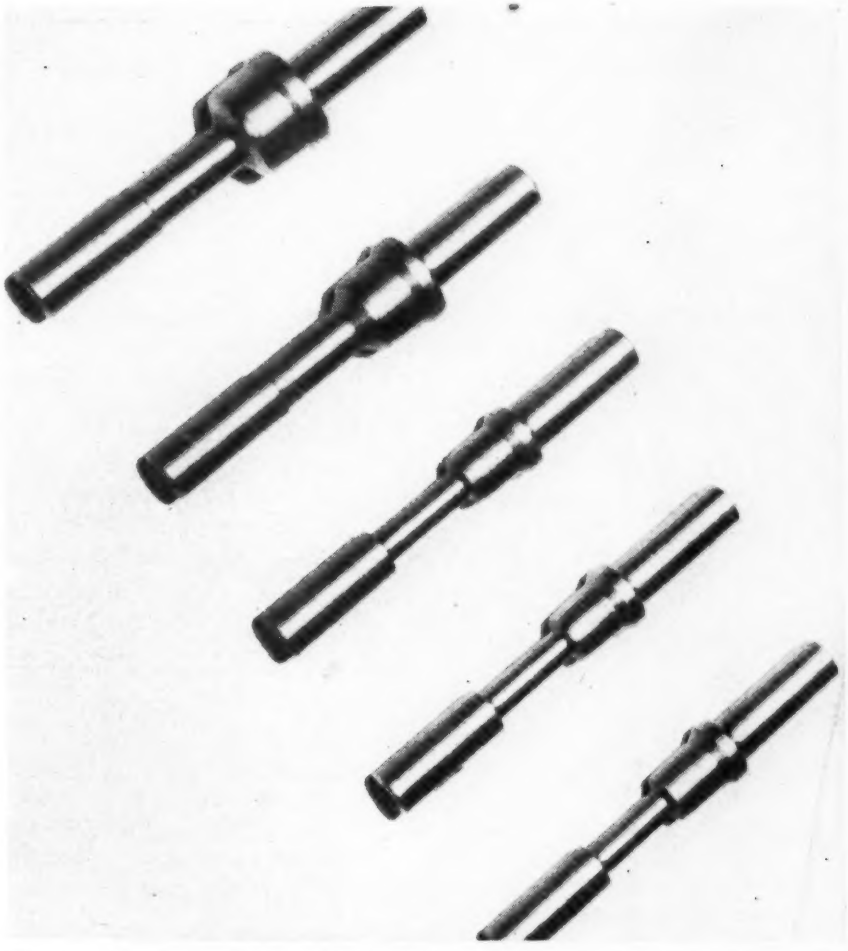


Fig. 5—A family of five equal-percentage annular plugs shows single-seat design for tight shutoff. Top and bottom guides keep plug aligned with its seat

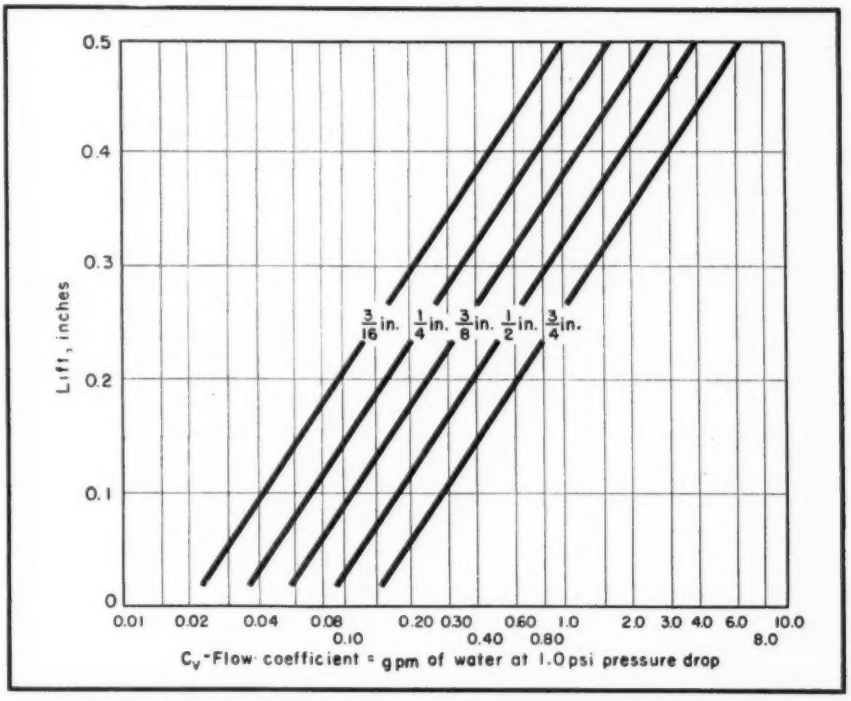


Fig. 6—Valve lift plotted against Cv flow coefficient of plugs in Fig. 5. Knowing the coefficient permits finding the relative capacity of various sizes

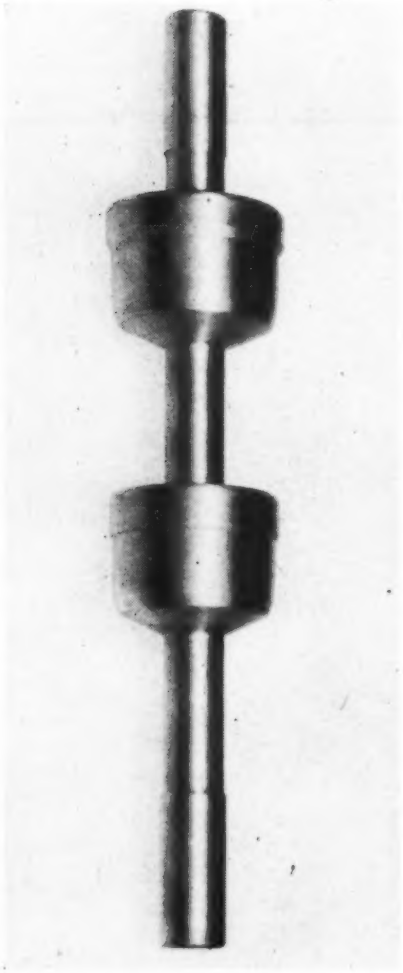


Fig. 7—Foreign material does not readily stick to equal-percentage plug

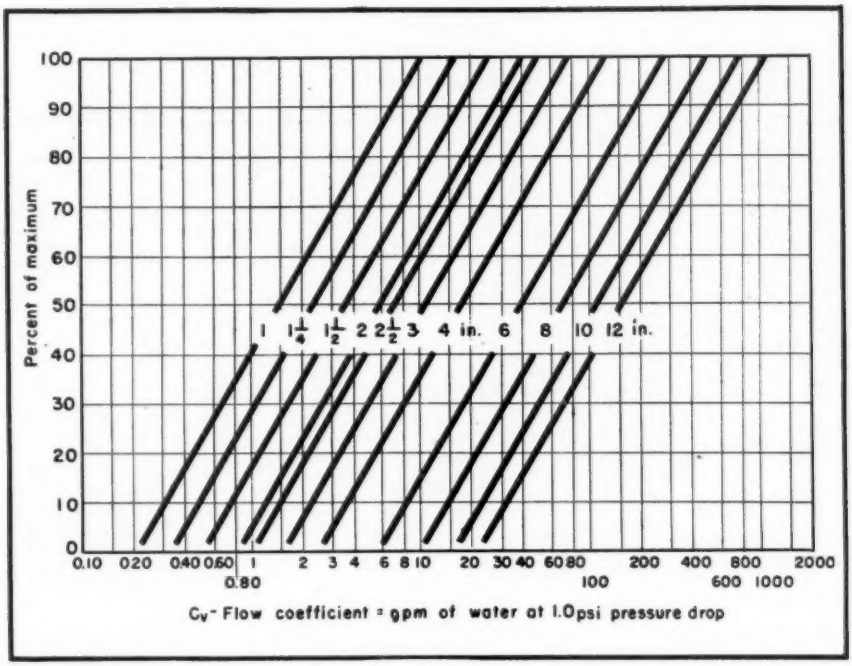


Fig. 8—Percentage of lift plotted against Cv flow coefficient for double-seated equal percentage plugs. Capacity can be found for any point of stem travel

1. A series of angular cuts on a piston plug which can be reproduced in any instrument shop in an emergency.
2. Common seat-ring OD.
3. Three seat sizes only, which requires changing only a plug and stem to change capacity.
4. High lift (½ in. in all sizes).
5. Related maximum flow capacities.
6. Reversibility from air-to-open to air-to-close action by reversing the valve body.
7. Tight shut-off.
8. Top and bottom guiding.

Fig. 6 plots valve lift in inches against *Cv* coefficient of the family of plugs in Fig. 5. We now have quantitative information and a definitely more useful type of curve than either Fig 3 or 4. In addition to the information given by Fig 4, we find the following:

1. Relative capacity of the various valves.
2. Ability to calculate valve lift accurately in inches at intermediate and low flows of the fluid being controlled.
3. A means of numerically expressing actual valve capacity.

Assume we select a ½-in. valve with a *Cv* of 4 as being suitable for maximum flow conditions, but wish to see what it will do at minimum flow, namely 1 gpm of water at 25-psi pressure drop. The *Cv* calculates $\frac{1}{\sqrt{25}}$ or 1/5 or 0.2. The curve, Fig 6, shows the valve will have a lift of 0.12-in. at this flow rate.

In Fig. 8 the percentage of maximum lift is plotted against *Cv* for double-seated equal-percentage plugs in sizes 1 in. through 12 in. These curves permit the same type of analysis as for the equal-percentage annular plugs. In sizes 6 in. and over, a skirt-type valve plug which produces the same flow characteristic can be used. When the valve lift is known, it is possible to calculate the valve capacity at any point of valve travel.

The equal-percentage annular plug, Fig. 7, used to produce the curves in Fig. 8, has many strong adherents in the chemical and petroleum industry because no material sticks to its surface. Best way to insure accuracy of contour is to use an optical comparator.

Blowoff Tank Explodes

► THE EXPLOSION of a cast-iron blowoff tank at a college power plant caused the death of a boiler-room operator, drove more than 200 students from their classes and necessitated closing the college for the following day.

One of two boilers at the plant was being blown down at a pressure of about 85 psi when the accident happened. It is not known for certain what caused the failure of the tank but it has been reported that the outlet pipe was clogged.

When the explosion occurred, a group of students gathered at the power house, and upon learning that one of the operators was in the steam-filled boiler room, the men clasped hands to form a human chain in a rescue effort. They were unsuccessful, however, and it was not until firemen arrived some time later that a complete search of the boiler room could be made. It was then found that the operator had been killed instantly by the explosion.—*The Locomotive.*

THE OPERATING ENGINEER

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Air Cooling Extends Furnace-Wall Life

Here's a plant where air cooling does just that. The furnace walls of two Economic-type boilers and one hrt were rebuilt to allow, in one operation, both air cooling that pays off in low brickwork upkeep and preheating of incoming underfire air

▶ FURNACE BRICKWORK that goes on and on with little or no maintenance represents ideal operation. Gordon E Sayre, plant engineer of the Boonton (N. J.) Molding Co, claims just that happy condition for his air-cooled Economic and hrt boilers.

Back in 1940, steam load at Sayre's plant had outgrown the combined steaming capacity of two Economic firetube boilers, one 5000 and the other 7500 lb per hr. To meet this growing steam load a second-hand 11,250-lb-per-hr hrt boiler was purchased. When it came time to set this newly acquired hrt unit, Sayre decided to put into effect some ideas he had formed for extending furnace-wall life under normal operation.

Changes in Design. This first step was to raise the boiler setting 28 in. higher than its steel work allowed. This he did by putting 28-in. concrete piers under the I-beams, Fig. 1.

Next he built a steel-lined concrete bridgewall, Fig. 2. Carborundum brickwork is laid over this concrete core. The steel lining—8-in. steel piping—defines the passageway within the bridgewall for air discharged from a 5-hp blower through an expansion joint. This air passageway, Fig. 5, divides at about the midpoint of the bridge to split the air flow across the bridgewall to each of the two sidewalls of the furnace.

Wall Construction. Sidewall construction embraces a 4-in. air passage between two courses of refractory and carborundum brick and two courses of regular brickwork forming the outer wall of the boiler setting. The brick of carborundum, laid with fireproof mortar lengthwise across the air passage, plus stay rods that run the length of this passage, Fig. 3, hold the construction rigidly in place. The tie bricks serve as baffles in the path of the air.

From this sidewall passage the air enters under the stoker firebed through two pairs of expansion-joint fittings, one pair for each sidewall, Fig. 5. Here the air passes through the fire to enter the combustion process.

The air flow from the boiler room into the blower, and through this cycle to the under side of the firebed, is under the control of dampers at the blower inlet. These dampers, in turn, respond to changes in steam pressure through a linkage system. Underfire air arrives at a pressure of 0.6 in. of water when the

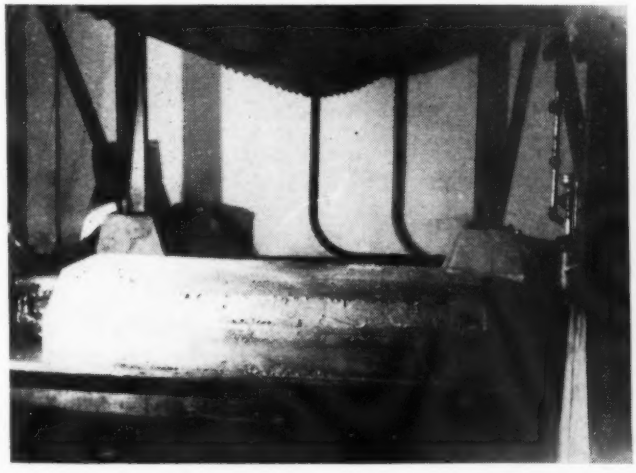


Fig. 1—Concrete pier (background) lifts boiler setting 28 in. above usual. Bridgewall core (front) is made of concrete

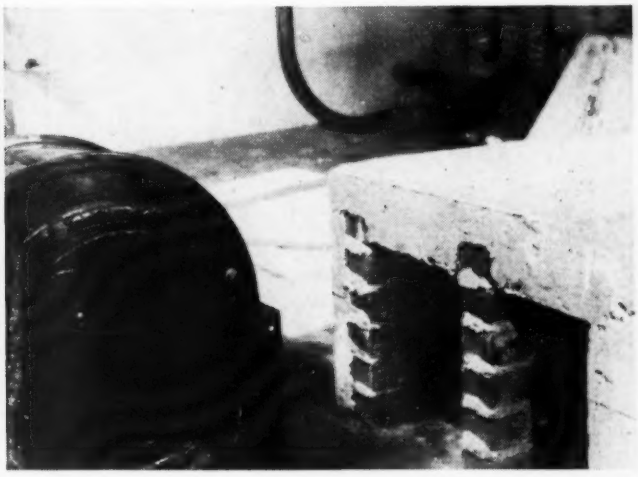


Fig. 2—Air from blower enters steel-lined bridgewall at rear opening, discharges into furnace sidewall from front

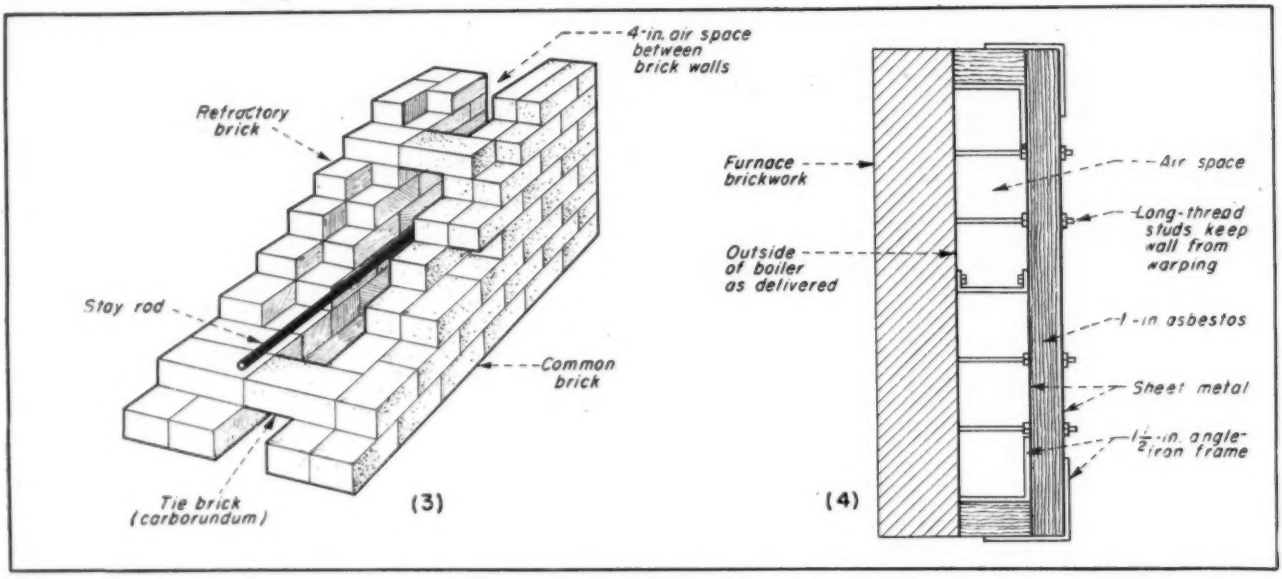


Fig. 3—A 4-in. air passage lies between 2 courses of fire-brick and 2 courses of regular brick for the hrt boiler unit

Fig. 4—The 4-in. air-cooling space on Economic units has sheet-metal edges, plus a 1-in. layer of asbestos as a seat

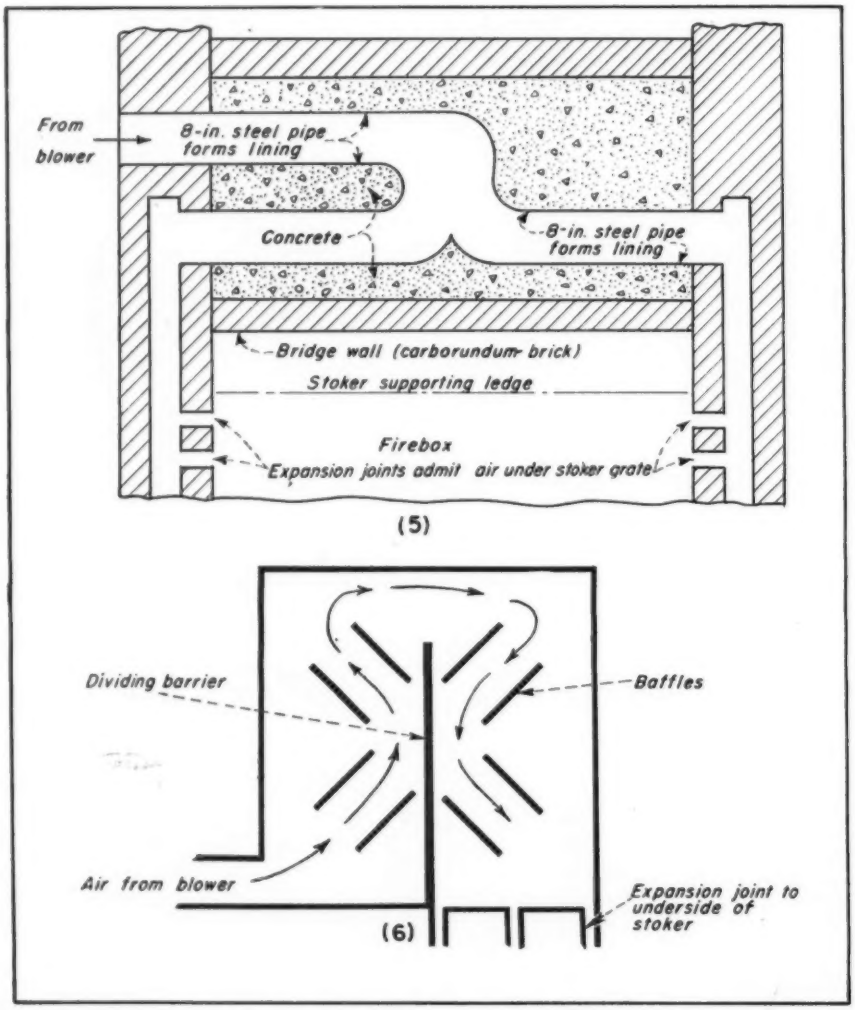


Fig. 5—Steel-lined concrete-core bridgewall of hrt (upper) has 8-in. piping to divide air flow from blower entering into furnace sidewalls and back under the stoker to the furnace. Fig. 6—Gives air travel in Economic boiler with baffles built into the sheet-metal-lined air passage to promote turbulence in air flow

damper is wide open. The natural draft is damper regulated to hold the furnace chamber under 0.10 to 0.15 in. of water.

Stack Support. The stack for this hrt boiler does not rest upon the boiler brickwork. Instead, it draws support from structural-steel bracing tied into the roof. A bonnet from the boiler gas outlet slips into this stack for final discharge. The bonnet acts as an expansion fitting between the rigidly set stack and boiler. This construction relieves the boiler brickwork of the extra load the stack normally imposes.

Operating experience on this specially constructed hrt furnace has been highly satisfactory. Early fears of possible stoker-maintenance problems from preheated underfire air never materialized. Slag formations on the inner facings of the sidewall build up in an unusual way. An air space of about finger thickness lies between the wall itself and a paralleling formation of slag. None seems to cling to the wall. During shutdown periods this formation is pulled down without any damage or tool work on the walls.

The furnace flooring beyond the bridgewall differs in its construction from the usual. Here 4-ft sections, with built-in expansion joints of the type employed in highway construction, make up the flooring. This construction has kept the flooring free of any cracking.

ECONOMIC BOILERS

The success of the hrt sidewall cooling prompted its introduction for the

Economic units already in operation.

With this type no bridgewall exists so air from the blower (5 hp for the 7500-lb-per-hr unit and 3 hp for the 5000-lb-per-hr) enters a ductwork that divides behind the boiler unit into two paths leading to each of the sidewalls.

Starting at the boiler exterior as delivered, Fig. 4, a 1½-in. angle-iron frame was erected the length and the height of the furnace sidewall and 4 in. out from the wall. To this a plate of sheet metal was added, then a 1-in. layer of asbestos and another metal plate.

Long-threaded studs, with nuts on each side of the metal plates encompassing the asbestos, run through to the old boiler exterior. These studs hold the metal wall surfaces from warping.

Within this boiler-wall addition are a series of baffles, Fig. 6, that give the moving air stream an added turbulence. From there, the air enters under the stoker firebed as it does in the hrt unit.

The Devil's Fruitless Morning

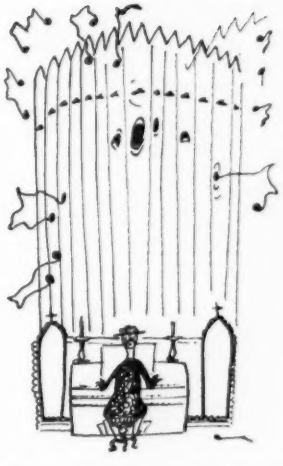
▶ WHEN I WAS in church Sunday, the devil kept putting idle thoughts in my mind as he is paid to do. "Who is that sitting over there?" "Wonder who is flying that plane?" "What time is it?" and similar nonsense. Then for some reason there came to mind the electric organ and the dither it caused when it was installed.

An electric organ depends for its tone and operation on quite constant voltage and frequency of the electric current. At the time the organ was purchased, the town was a lot smaller than now and the electrical facilities somewhat limited. Part of the power was derived from a small hydro plant on the river. On Sundays the hydro plant could handle the load alone and no fuel had to be burned for power. All was well except that the elevators in the hotels kept the voltage jumping and the frequency or speed of the plant constantly changing. This really messed up the organ. When the organist struck a key for one note, because of the wrong electrical characteristics she got something else. Imagine what that did to the hymns—if you can.

"—the devil's idle thoughts"

It seemed that the only thing to do was to pay an engineer Sunday and run an engine to balance the elevators; in other words, spend quite a sum of money for about 2¢ worth of electricity. Finally, we decided to make a balance wheel out of a spare diesel set.

We pulled out the pistons and ran the generator as a synchronous motor. (Starting up the set was something else, but we got it going.) The flywheel was very heavy and the set worked fine for a year or so, or until the load built up to where engines had to be operated all the time. The voltage and frequency smoothed out perfectly, or anyhow perfectly enough to operate the organ satisfactorily and to allow us to run on the hydro plant when the load was light.



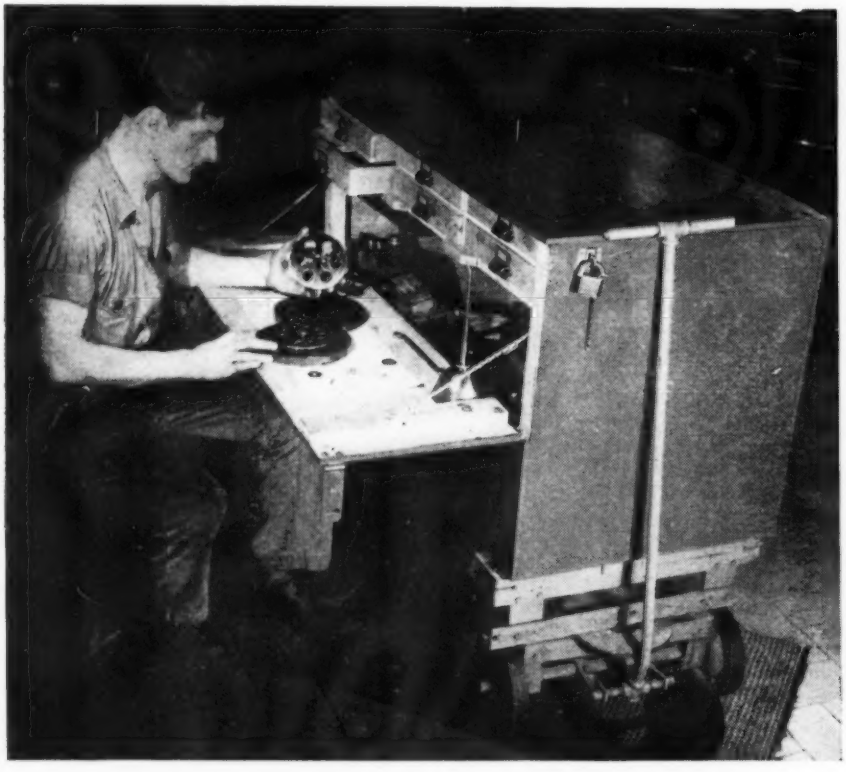
"—all notes were wrong notes"

One funny result was that an insurance company inspector (flywheel insurance) ordered the set shut down, on the grounds that the governor was disconnected and the rules provided that "no engine might be operated with the governor disconnected." He would not listen to the argument that the engine was not really running, and the waterwheels could not run away with the load, and if the load went off so would power since the plants were miles apart.

Anyway, the devil spent a fruitless morning if he succeeded in getting no worse reaction than this!—*E A Roberts*

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



SHOP FOR REFRIGERATOR REPAIRS

WE HAVE ABOUT 25 refrigerating machines in different parts of our hotel. These are too large to bring to the shop for servicing where all tools are available for the job. Therefore, they have to be overhauled in place and the tools and other equipment for the work taken along.

This was not satisfactory because the mechanics never seemed to be able to collect the necessary material and take it onto a job. Consequently, they lost a lot of time traveling between job and shop for needed equipment.

Since the machines could not be brought to the shop for servicing I decided to take the shop to the machines. I built the portable shop, in the photo, which is housed in a cabinet built of plywood screwed to a heavy wood frame.

The top part has six drawers divided to hold screws, bolts, and small fittings and parts for replacement in the machines. Different sections of the drawers are inventoried so the mechanics can easily see if the supplies are complete before taking the portable shop to a job.

Large tools and parts are kept in the bottom of the cabinet, which has a door that can be closed and locked. This door covers about one-half of one side, is hinged at the bottom, and swings down to form a bench at which a worker may sit when cleaning, adjusting or repairing small parts. The cabinet's top may be used for the same purpose.

Since the photo was taken a small vise has been added to the cabinet's top.

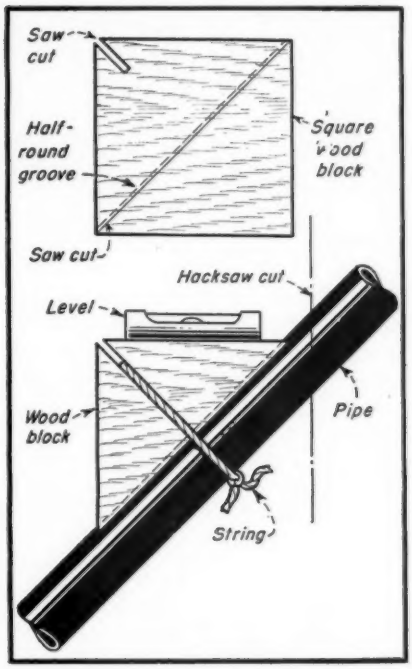
Being mounted on a truck the shop is easily portable so the workmen do not hesitate to take along everything required, or which they think might be needed for the work in hand. Consequently, they go onto a job fully prepared for practically every condition that may develop.

New York, N. Y. A C HICKEY

Pipe Setup for 45-Deg Angle Cut

SINCE AN ANGLE of 45 deg is most commonly used in pipe fittings it is well to have a convenient method of setting up the work to make the cut at this angle. Figures below show a method I use, which consists of a wood block and a small level.

First saw a square block of wood in two from corner to corner, Fig. 1. Then in the diagonal face of one half, cut a half round groove that will fit onto the pipe. Make a cut in the right-angle corner to provide a slot for tying the block to the pipe with a string, Fig. 2.



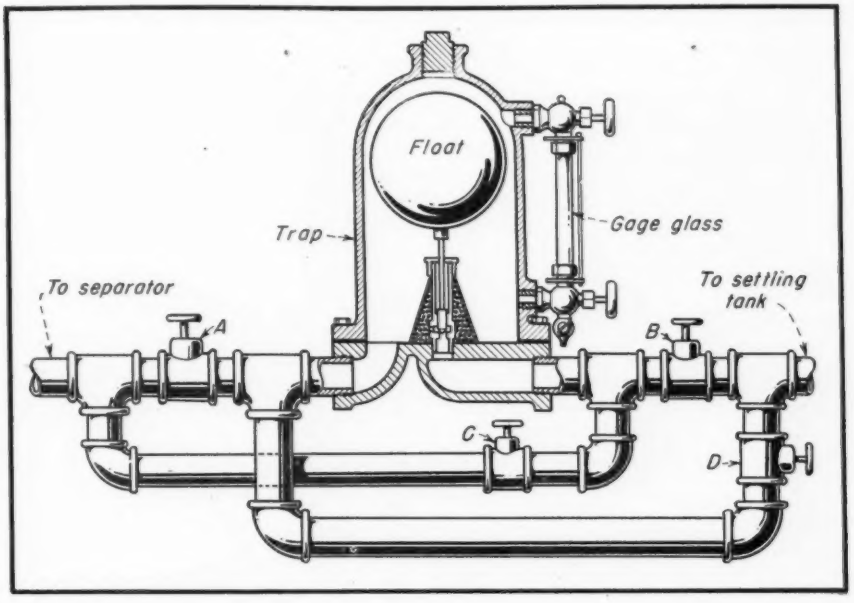
Raise one end of the pipe and when a small level on the block comes level the pipe is at an angle of 45 deg. A vertical cut made with the pipe at this

angle will cross the pipe at a 45-deg angle and the two cuts will fit together to form a right angle.

Leeds, England H MOORE

Backwashing Cleans Screen of This Trap

STEAM-ENGINE EXHAUST for our plant heating and process at 35 psi goes through a separator that removes condensate and oil, which is trapped to a settling tank. After the trap is in service for a while its strainer and valve become clogged and have to be cleaned. To avoid dismantling the trap we connected it as in the diagram.



During normal operation valves *A* and *B* are open, and *C* and *D* are closed. When we clean the trap by backwashing we close valve *B*. This stops trap discharge and it fills with condensate. When the trap is nearly full we close valve *A* and open *C*, which admits condensate from the separator in counterflow to the trap. Valve *D* is now cracked open to allow some condensate to escape from the trap. This flow is replaced by condensate and steam from the separator, which can be checked by a clacking noise of the trap's valve moving off and onto its seat.

This operation is continued for about two minutes, after which valve *D* is opened wide and everything blows out from inside the trap. After this backwashing, valves *A* and *B* are opened, and *C* and *D* closed to put the trap back in service. Effectiveness of backwashing is apparent by the condensate's clear color in the gage glass.

Paterson, N. J. F M GIORDANO

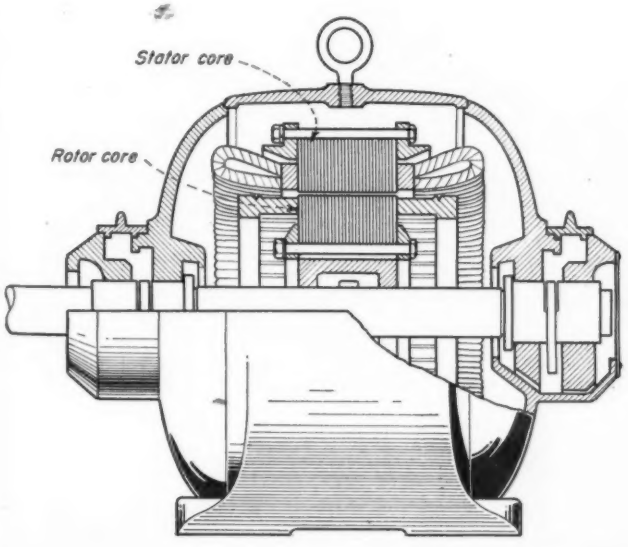
REVERSING MOTOR STATOR PUT THRUST ON BEARING

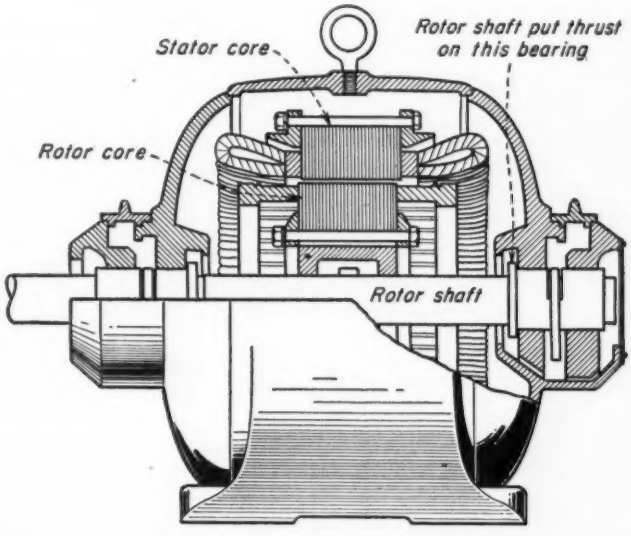
THE SYMMETRICAL DESIGN of a squirrel-cage induction motor makes it possible to turn its rotor, end for end, in the stator without affecting the motor's operating characteristics. Like most rules there are exceptions.

In a Western power plant, for instance, a 250-hp squirrel-cage motor was installed to drive an induced-draft fan. When the motor started, its outboard bearing overheated excessively after a few minutes' operation. Much time was spent aligning the motor with the fan and checking the bearing, but the latter overheated quickly when the unit was started.

After checking everything that might possibly cause the trouble we removed the motor's rotor and turned its stator end for end. We reasoned that maybe the motor's construction was not exactly the same at both ends, and because of this the magnetic centers of the rotor and stator were out of line. This would have produced a heavy end thrust of one shaft collar against its bearing to cause overheating.

After the stator was turned the bearing temperature remained normal during several hours' operation. We dis-





covered later that the stator had been turned end for end just before the motor was installed, to make its conduit box line up with an incorrectly placed sleeve in the floor slab through which the conduit connection was to be made.

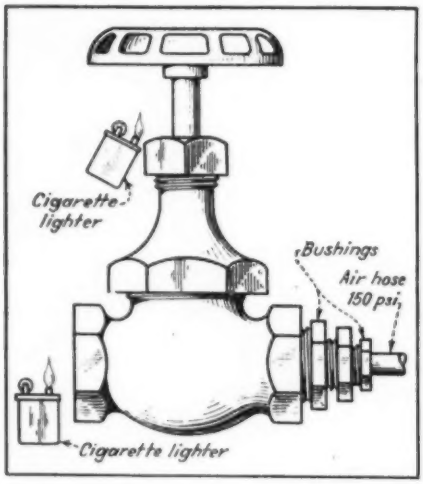
Fig. 1 (left on preceding page) shows how stator and rotor cores lined up in the original assembly. Fig. 2 (on right) indicates how the rotor core was out of line with the stator when the latter was turned end for end. The two being out of line produced a heavy thrust of the shaft collar against the right-hand bearing, causing it to overheat.

New York, N. Y. H CARL BAUMAN

Cigarette Lighter Tests Valve Leaks

RECENTLY WE RECOVERED several hundred dollars worth of valves from a lot of dismantled piping, some ancient and some in use a comparatively short time. We had the problem of finding a simple testing method to determine which valves were tight and which needed repair.

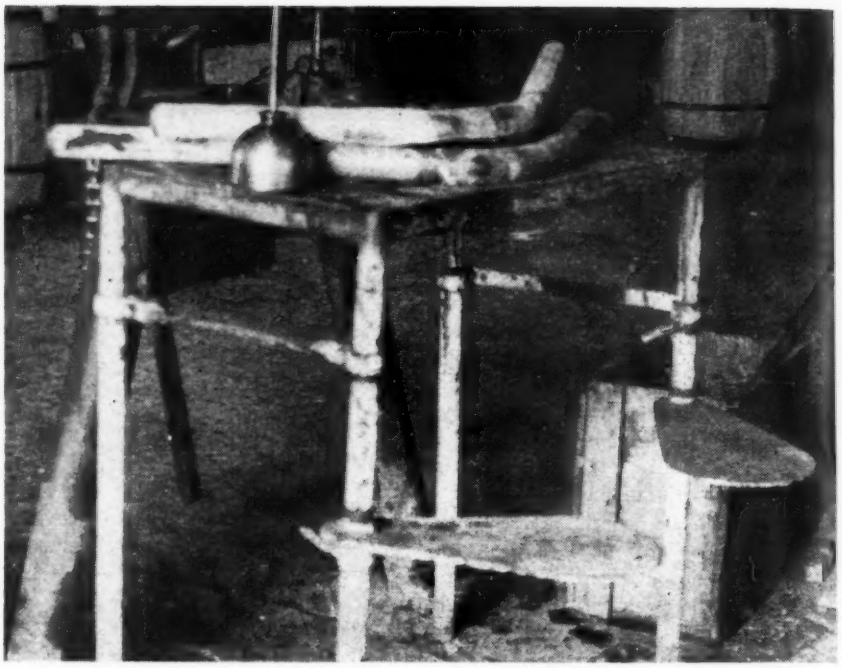
After cleaning the valves of scale and



dirt we assembled a nest of bushings on the end of a compressed-air hose. The bushings permitted us to connect the hose readily to different-size valves, as in the figure. The hose was connected so as to put pressure on top of the valve disk and on the packing to test both at the same time.

After opening the valve to blow out the dirt and scale it was closed. Next a cigarette lighter was held at the valve's open end; if there was a leak the lighter blew out or the flame bent away from the valve. The valve-stem packing was also tested with the lighter as shown.

Cleveland, Ohio LAWRENCE E. PILE



SWING SEATS PUT WELDER AT EASE

WHEN A WELDER BUILDS up small pieces of equipment or makes intricate welds he takes many different positions to reach his work. To make the necessary positions comfortable, swinging steps or seats attached to the legs of the welding bench have proved their worth.

The seats are cut from fairly heavy plate steel because of its resistance to bending. These are fitted over bushings placed on the vertical legs of the bench, as in the photo, and are held in the desired position with setscrews. The seats are free to rotate on the bushings to any position of a complete circle so the welder can make changes to suit varying postures.

Cleveland, Ohio A C WIGGINS

Test Detects Carbon-Tetrachloride Vapors

OUR RESEARCH LABORATORY developed a simple test for determining carbon-tetrachloride vapors in the air. Because of its simplicity and the speed with which it can be applied, the test may prove useful in industrial plants and laboratories, including dry-cleaning establishments, where a quick, rough check on air purity is desirable.

Equipment required for the test includes: (1) an alcohol lamp and (2) one foot of ordinary bell or other untinned copper wire of comparable size. One end of the wire is stripped clean of insulation and formed into a spiral coil of three turns, 0.25 in. diameter. After lighting the lamp, insert the copper-wire coil into the base of the flame and note the color in its upper part. A carbon-tetrachloride concentration in air exceeding 5 parts per million gives the flame a slightly green color. If certain other undesirable volatile chlorine compounds are present, the test may also show the green coloration.

To familiarize yourself with the green color, pour a few drops of carbon tetrachloride in a small glass container, and shake. Then heat the coil in the lamp's flame, after which insert it in the glass for a few seconds just above the carbon tetrachloride. Put the coil back into the flame when an intense green color will develop. To make the actual test, discard this coil and use a fresh one as it is difficult to burn off the carbon tetrachloride.

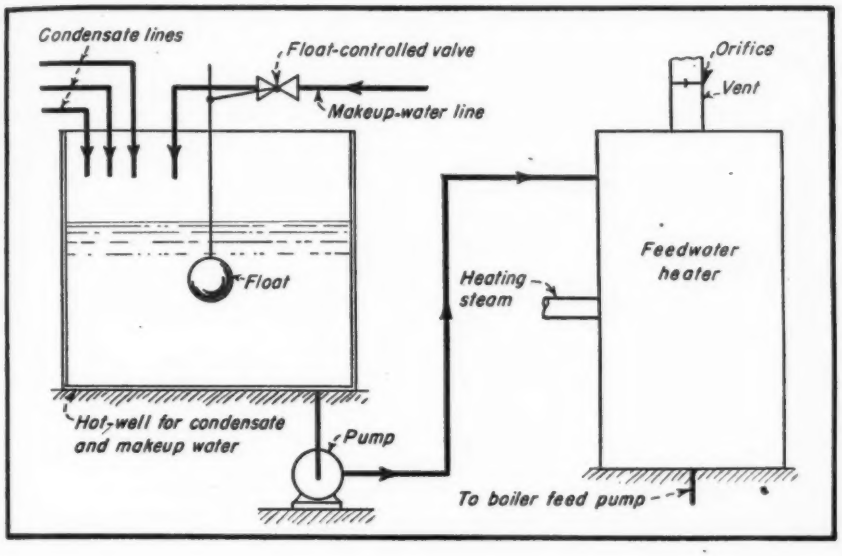
When the alcohol lamp is burning properly its flame should be bluish in color with little or no luminous section, and be about one inch high. In the presence of carbon tetrachloride, when the copper coil is held in place the greenish tinge imparted to the flame is of fairly brief duration. After the wire becomes red hot stop the test. If carbon tetrachloride is present in the air the

green color should appear in less than a minute after inserting the coil in the flame. The green color is best observed against a dark background.

Have the wire coil cooled to room temperature before insertion in the flame. Do not use this test where explosive vapors are present. To prevent the formation of phosgene, do not let the alcohol lamp burn longer than necessary to perform the test in air containing high concentrations of carbon tetrachloride or other chlorinated hydrocarbons.

Do not consider this test a substitute for highly accurate quantitative ones conducted by an experienced laboratory technician.

Southbridge, Mass. RAY GENTZLER
American Optical Co



HOTWELL TAKES KINKS OUT OF FEED HEATER

WHEN OUR POWER PLANT was built it was equipped with an open heater to which all feedwater (condensate and makeup) was piped. From the start this equipment gave trouble. Condensate, primarily from exhaust steam for plant heating, collected in receiver tanks in different buildings and was pumped to the feedwater heater by motor-driven pumps, controlled by on-and-off float switches. Exhaust steam heated the feedwater

With this setup, when a condensate pump was running the heater got only condensate. But when condensate was not being pumped, only cold water came into the heater. Then the steam demand to heat this water was greater than the system could supply. As a result, feedwater temperature varied widely; pressure in the heater dropped with consequent air entrainment in the feedwater.

After several months we corrected this condition by installing a hotwell into which all condensate and makeup water were piped. A float-controlled valve in the makeup line kept water in the hotwell above a predetermined level. This level was set low enough so that the hotwell could hold all condensate that came to it at any time. From the hotwell we pumped the water to the feedwater heater as in the diagram.

Temperature of water fed to the heater now varies gradually and within 20 F limits. Heating steam demand is more constant and within the limits of the supply. We can maintain a steady positive pressure in the heater at all times, thus avoiding air entrainment in the feedwater and wide variations in its temperature.

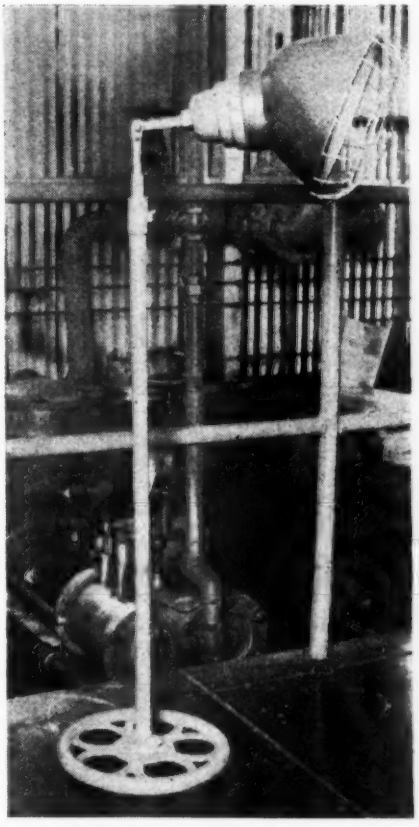
Glen Rock, N. J. A N MUSGRAVE

Simple Device Keeps Attendant on the Job

WATER, TAKEN directly from the city mains, is stored in elevated tanks for service and process in our plant. It is one of the watch engineer's duties to keep these tanks full, by opening a valve in the city water line where it runs through the boiler room. The tank overflow line also passes through this room.

Sometimes the engineer used to turn on the water and forget to close the valve when the gage in the boiler plant showed a full tank. I stopped this oversight with a simple trick. I bored a $\frac{3}{8}$-in. hole in the bottom of the overflow line and put in a short connection that would drain onto the boiler-room floor. Then if the tank overflowed, water flowed onto the floor. Not only did the engineer have to clean it up, but it was also a telltale that showed he was not on the job. Needless to say, he watched the water-level gage, and closed the valve before the tank overflowed. No longer is water wasted because of this oversight.

Chicago, Ill. R C HENDERSON



Portable Floodlight For Maintenance Work

TO CONCENTRATE illumination on equipment being repaired at night or in dim buildings, a portable floodlight is of assistance to a mechanic. To make one that stays put attach a small flood lamp head to an adjustable arm connected to a convenient length of stiff pipe. The opposite end of the pipe is set in the center hole of a heavy cast-iron valve wheel, as in the photo, which serves as a base for the lamp. The base should be as heavy as possible to prevent the lamp tipping over.

Cleveland, O. A C WIGGINS

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

1—What Is Synchroscope Connection Reference?

WE HAVE a steam-electric power plant with a 2300-v bus. There are four steam-driven generators connected to the main bus. We also have a hydro plant, some distance away connected to this bus by transmission line and step-down transformers. This connection is on one end of the bus. On the other end, we have a connection through transformers and transmission line to a local power company. This means there are four generators and two incoming transmission lines connected to our bus—all through oil breakers as in sketch *September Q-1*, at the bottom of page.

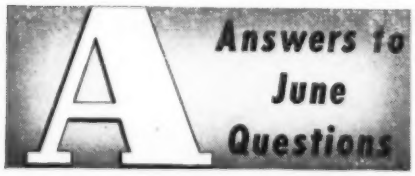
At present, we do not use the steam-driven generators, but they are connected as incoming on the synchroscope. The hydro connection is made in the same way. If the synchroscope shows the hydro is too slow, when synchronizing, we call by carrier phone to have the operator speed up. Now we have added the power company connection. There was some question about how to connect the synchroscope. It was finally connected for incoming, the same as the hydro and steam-driven generators. The argument against this connection is that if, in synchronizing the "scope" shows the power company fast, we have to call the hydro station and have the operator speed up because our system has to match the power company's. If we are putting a local generator on the line and the scope shows fast, we have to reduce the speed of the incoming machine.

With the present connections, we have treated all incoming lines and machines as "incoming" in relation to our bus. When phasing in, the operator has to remember whether he is phasing in local hydro, or power company's system to know what to tell the hydro operator to do with his machines. If the power company connection had been made reverse to present connection, then, regardless of which transmission line is phased in when the local operator sees the scope reads fast, he tells the hydro to slow down; if it reads slow, he tells the hydro to speed up. This would eliminate any thinking on the operator's part, but might cause trouble for engineers or others if there were any trouble, or rebuilding or work on the switchboard.

I would like to know the general practice among power companies or engineers? The circuit in an engineering book shows all connections incoming to the bus.—*JBG*

2—Why Does Engine Pound On Low Steam Pressure?

WE HAVE a 150-hp corliss engine, which produces 140 kw with apparent ease at 135-psi steam. If the fireman lets the pressure drop momentarily to 125 psi, we get a decided thump in the pillow block main-bearing. Will POWER readers tell me what causes this trouble and offer a possible remedy?—*JJD*



Why Do Solenoid Valves Stick Shut?

(This is Question 1 from the June issue, with best answers from readers)

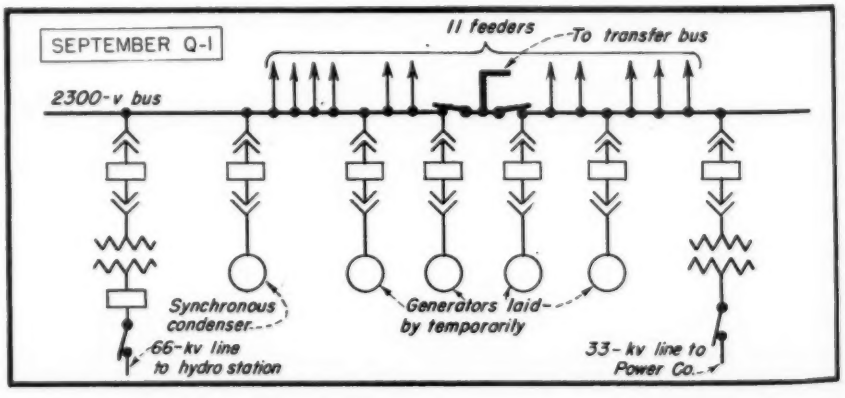
IN OUR ICE *and cold-storage plant, solenoid valves in one of the departments do not work satisfactorily. In the frozen-food section, where the trouble, occurs, there are three compressors. One is for the locker room and deep-freeze cabinet. The second is for the cutting room, and the third for the chilling and aging room. It is the valves in the chilling-room system that are giving trouble. They stick shut and will not open.*

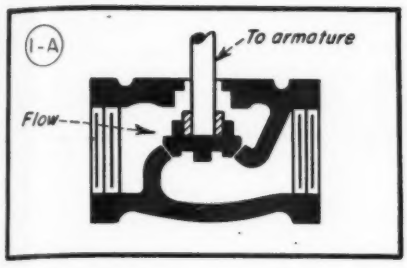
Refrigerant is Freon-12, and the solenoid valves are located in the liquid lines. The room temperature is 32-35 F. The backpressure is 20 psi and the head pressure is 115-120 psi. Each valve is rated 16 watts at 115 v. I have checked the refrigerant—there is no shortage. The voltage at valve terminals is 112 v. New valves that worked satisfactorily in other locations are no better. The thermostats and expansion valves have been checked and are in good condition.

As long as the machine is running the valves work fairly well. But when the compressor stops and the thermostat calls for it to start again, the valves will not reopen. There is only a loud chattering noise. If we open and close the circuit to each valve several times it will sometimes open with a hissing, humming noise. Can POWER *readers suggest what is wrong with these valves or why they don't work here as they should?—HF*

Pressure Is Too High

SOLENOID VALVES are designed to operate within a certain maximum pressure range of the controlled liquid or





gas. If this pressure is exceeded, the valve will not operate satisfactorily. The high pressure over the valve disk, sketch 1-*A*, overcomes the force of the solenoid.

Surges caused by opening and closing the control switch keep opening the valve a small distance each time until the pressure is reduced enough to allow the valve to open.

If working pressure is reduced the valve will operate satisfactorily.

Brooklyn, N. Y. F J ARDOLINO

Foreign Material Clogs the Valves

HERE ARE some conditions that cause trouble with solenoid valves. Within all refrigeration systems there may be small metal chips from machine work, particles from sawing and filing of tubing, scale from soldering and welding, and a variety of other foreign matter. Such particles are likely to clog the small opening in the solenoid needle valves. This causes binding of valve plunger. Freon-12 refrigerant especially has the property of loosening and carrying through the system all manner of particles that may cause trouble. To prevent this, as far as possible, place strainers or filters in tubing lines ahead of all solenoid valves. Service valves should be installed between each end of the screen or filter to allow removal and cleaning without losing refrigerant or allowing air to enter other parts of the system.

Oaklyn, N. J. C A WILKS

Solenoid Valves Are Out of Plumb

I THINK the trouble is improper installation since HF's liquid-control assembly and his other solenoid valves are working properly.

To give satisfactory service, a solenoid valve must be installed plumb, otherwise its plunger is pulled off vertical line by valve coil. This causes plunger to chatter and cling to inclosing tube. Under this condition, valve usually fails to operate properly. *HF* will probably find that complete assembly is out of line from strainer to solenoid valve, causing unbalance in solenoid.

Quincy, Fla. D J PARMER

Solenoid Valve Freezes Up

IF THE SOLENOID VALVES operate in a room with temperature of 32-35 F, just near freezing, there is undoubtedly a certain amount of condensation due to the chilling process. Condensate does not freeze when the compressor is running, the Freon-12 is in motion, and heat is being generated from the solenoid coils. Then the valves operate freely. When the compressor is shut down, heat is conducted away from the large valve surface so rapidly that the condensation freezes. The solenoid valve is probably designed for low or normal pull, which is not sufficient to break the plunger away to open the valve. By opening and closing the valve circuit a number of times, the high inrush current, the resulting intermittent pull and the transfer of the electromagnetic energy into heat is enough to thaw and break away the frozen valve.

Chattering is probably due to linkages in motion when the solenoid is energized and de-energized. Humming sound is the coil inductive pull on the magnetic plunger inside the coil. Hissing is the thawing of the valve and flow of refrigerant through the orifice of the partially opened valve. *HF* has these alternatives for correcting the condition:

1. He can replace the existing valves with new ones having larger solenoids. These new solenoids should be designed for a heavy pull which will produce enough force to reopen the frozen valve. This makes a permanent installation.

2. He can install a Micarta box over the solenoid valve in which is mounted a heater element or a 25-watt lamp. This arrangement is effective in keeping the valve from freezing. I have seen it used on similar installations where frozen, sluggish solenoid plungers caused faulty operations.

I caution against repeatedly opening and closing the highly inductive solenoid circuit unless it is properly protected. Enough voltage may be induced in the coil and circuit during these operations to cause eventual breakdown of the insulation, particularly if it is old and has deteriorated.

Tenafly, N. J. K B HOFFMAN

(Continued on page 162)

Should I Add Compound To Individual Boilers?

(This is Question 2 from the June issue, with best answers from readers)

OUR BOILER ROOM *contains six boilers in two banks of three each. There is one water softener that feeds makeup water to the six boilers. I have noticed that every time we cut a boiler in or out the concentration of alkalinity or hardness becomes affected.*

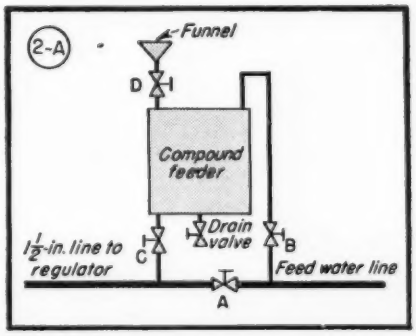
I thought maybe we could add a container to the feed line for each boiler so that additional compound could be added whenever necessary under the changing conditions described.

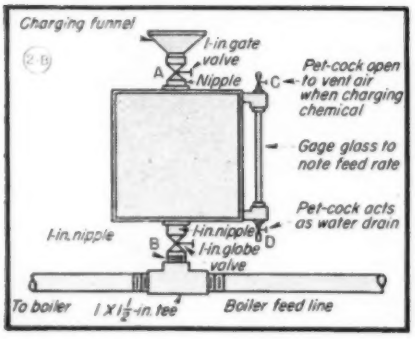
Would this container act as an air chamber in the feedwater line, and thus cause damage to the system? If POWER *readers have used a similar scheme, I would like to see a sketch of it. The diagram page* 110 *June* POWER *shows the arrangement I have in mind trying. Do you think it will work?—HB*

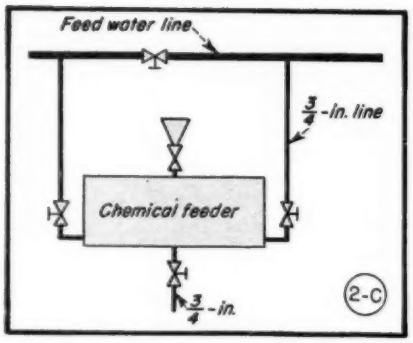
Individual Feeders Operate Best

COMPOUND SHOULD BE ADDED to each of *HB's* boilers individually as needed. Feeding enough compound to create proper alkalinity in one boiler with a low reading through a common feed line will result in overcompounding the other boilers. This necessitates excessive blowdown of the overcompounded units with loss of heat and soft water.

A compound injector should be installed in each boiler line, but I recommend a different installation from that proposed by *HB*. He hasn't given his boiler pressure, but the feed line necessarily carries a higher pressure than the boiler. Since his proposed installation is an integral part of the feed line, any repairs to the compound feeder require boiler shutdown. Also, improper operation of the feeder causes it to act as an air chamber. I suggest installing compound feeders similar to those in sketch 2-*A*.







All piping, valves, etc, should meet Boiler Code requirements for feedwater piping. The compound feeder may be fabricated of large pipe.

In operation, compound is poured into the feeder, and enough water added to bring the level above the funnel bottom. This excludes all air from the feeder. Valve *D* is then closed, valves *B* and *C* are opened, and *A* closed. After about 15 min, valve *A* is opened and *B* and *C* closed. The drain valve and *D* are now opened. Test the water from the drain valve. If it is heavily compounded, repeat the cycle.

Brooklyn, N. Y. C A HENIGAN

Use Additional Chemical Feeder

IF ADDITIONAL COMPOUND is to be supplied to each boiler, *HB* should feed it through a chemical feeder installed as a bypass around the present feed line to boiler. Wherever possible, discharge from chemical feeder to boiler should bypass all present regulating and control valves to eliminate chemicals passing through them. Chemicals should be fed through at one shot by opening bypass valves *A* and *B* and closing main-line valve *C* sketch 2-*D*. After tank has discharged into boiler, *C* is opened and *A* and *B* closed.

Ft McPherson, Ga. J M O'LEARY

Portable Tank and Pump Will Do a Better Job

MOST SATISFACTORY METHOD of adding compound to the feedwater of individual boilers is to use a portable tank and pump as in sketch 2-*E*. This eliminates the possibility of air entering the system. The compound can be dissolved in the tank and the outfit wheeled from boiler to boiler for charging.

If *HB* has a condensate-return system and feedwater heaters he can install recirculation lines. They will improve conditions and keep up the pH value of the feedwater.

Parr, S. C. V C SUMMER

Put Chemical Feed In Bypass Line

ADD CHEMICALS to each individual boiler. It is rather difficult to maintain them within the required limits when fed to the boilers through the main feedwater line unless feeding is continuous. At the time the chemicals are delivered through main feed line, some boilers may be taking water faster than others. This results in uneven distribution of chemicals to the battery of boilers.

HB has an excellent idea in equipping each boiler with a chemical feeder. This will enable the operator to proportion the chemicals to each boiler after boiler water has been analyzed. The chemicals can also be brought up to the required limits in the boiler water in a very short time after it goes into service.

To improve the chemical feeder, I suggest *HB* install it in a bypass line instead of a feedwater line. This will prevent cutting off the water supply to the boiler completely while the chemicals are put into the feeder.

If individual feedwater lines are several feet above the floor, install the feeder in a convenient location to provide filling from the boiler-room floor. Sketch 2-*C* shows a chemical feeder installed in bypass line as described.

Atlanta, Ga. A H THOMAS

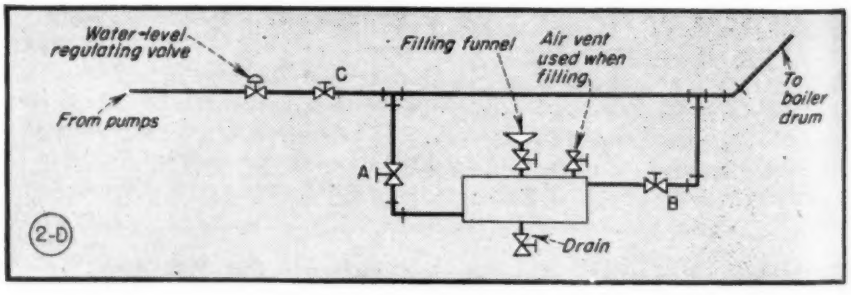
Put Feeder on Each Boiler

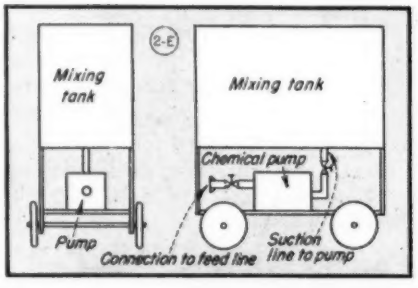
CHEMICAL FEEDER as described by *HB* will work. I suggest he install it above feed line as in sketch 2-*B*. Then feedwater will not need to be shut off to the boiler and chemical feed can be controlled by regulating valve *B*. This hookup eliminates pressure drop in feed line except that of normal friction. To operate, close valve *B*, open *A*, open petcock *D* to drain water; close *D* and open petcock *C* to vent air when charging compound through *A*. After feeder is completely filled, close *A* and *C*, then regulate feed by opening *B* the desired amount. A chemical feeder can be installed in branch feed line to each boiler, on either boiler side or pump side of regulator, whichever is most convenient for operation and installation.

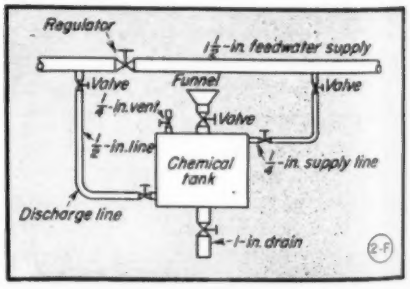
Montreal, Que. ARTHUR BELTON

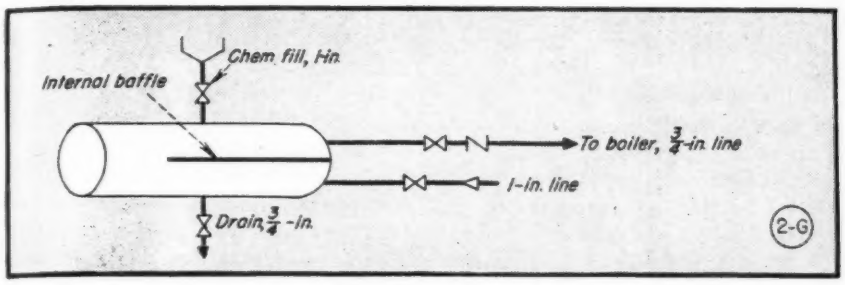
This Chemical Feed Works Satisfactorily

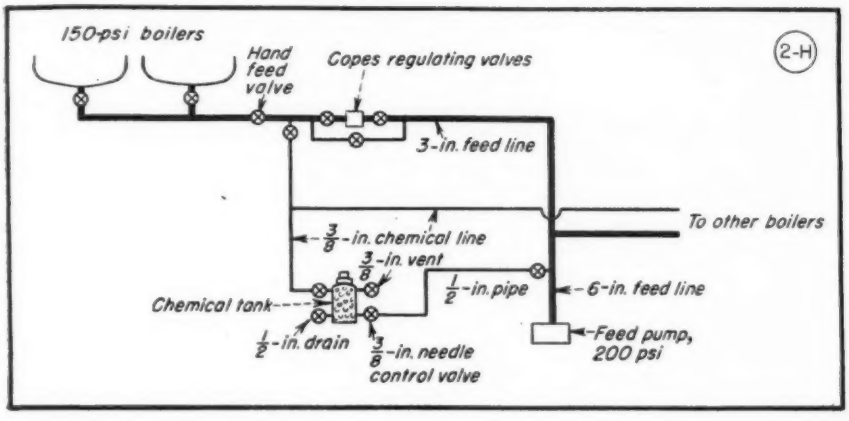
IN FEEDING CHEMICALS to individual boilers, *HB's* arrangement would not be as satisfactory as that in sketch 2-*F*.











Supply line takes feedwater from line ahead of regulator and it runs through a ¼-in. pipe to chemical tank, then out through a ½-in. pipe to feedwater supply line behind regulator.

In *HB's* diagram the chemical tank would not function unless the regulator were open and admitting water to the boiler. Also, chemicals in passing through a regulator tend to settle out and thus foul it.

The diagram shows a chemical-feeding supplementary system I used at Allison Division of General Motors Corp at Indianapolis, Ind. It worked satisfactorily.

The object of the ¼-in. feedwater line to the chemical tank is to throttle to any desired feed. The ½-in. discharge pipe from the tank is to allow the chemicals to move through the line without too much friction.

Seattle, Wash. H E ARMSTRONG

Use Circulating Header

BY ALL MEANS devise a way to add compound to individual boilers. It is extremely difficult to keep boiler-water concentrations within allowable limits any other way.

The Roberts conditioner, which we use to add chemicals to our boiler, works very satisfactorily. I believe one unit would add chemicals to six boilers by using method in sketch 2–*I*. An orifice is placed in the feedwater line to each boiler and piping run from the high and low side of the orifice to the headers *A* and *B*. The pressure differential across the orifice causes water to circulate as shown by the arrows. This picks up the chemicals from the conditioner and takes them to any boiler.

A stop valve is placed in each individual line. In the sketch, chemicals are being added to boiler No. 1. Stop valves in line 1 are open. Valves in lines 2 to 6 inclusive are closed.

Ninety-Six, S. C. E W MCKNIGHT

Use One Container For Chemicals

BECAUSE OF CHANGES necessitating intermittent operation and varying output of several of our boilers, we ran into a problem similar to *HB's* some time ago. We solved the problem by using one chemical container for five boilers, piped as in sketch 2–*H*. We use the feed-line-to-boiler pressure differential of 50 psi to give flow through the container. We are perhaps lucky to have such a high pressure, but anything over 15 psi should be effective for the piping shown.

We use solid chemicals in ball form. The container has a 4-in. diameter neck and screwed cap.

Flow control of injection of chemicals into the boiler is through a ⅜-in. control needle valve with a disk on the stem marked in tenths of a turn. We inject the required chemicals while feedwater is flowing and the boiler either steaming or filling.

Control could probably be centralized. Also, piping and connections, as shown, could be improved by using more pipe and installing a manifold at tank outlet with connections and lines to each boiler. But we find our installation satisfactory as it is and prefer that operators check all valves when using the system.

St. Joseph d'Alme, Que. V FOYLE

Provide Separate Chemical Treatment For Each Boiler

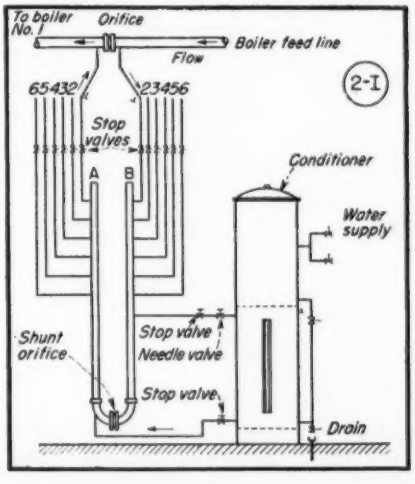
HB MUST PROVIDE separate chemical treatment for each boiler since the boiler water is always different. This is particularly true after a unit is shut down and drained. When it is started up again, even on makeup water, alkalinity and oxygen content will differ from that in other boilers. When they are all operating at about the same load, there is probably not enough variation to justify separate treatment for each of the six units, but tests can easily verify this.

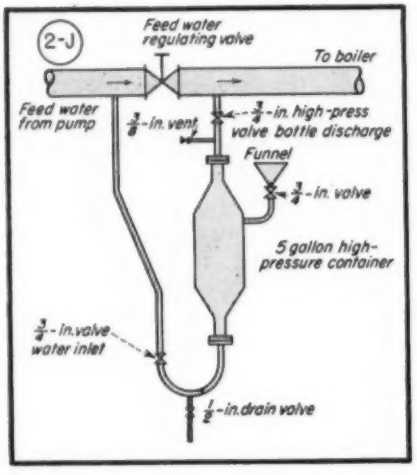
HB's arrangement will work satisfactorily, but sketch 2–*G* shows another version that has worked well for us.

With proper care in venting the tank, there is no reason for damage. A separate drum connection is preferable, arranged with an internal pipe to discharge near the feedwater inlet and away from the continuous blowdown if one is used. The ¾-in. line to the boiler should be wide open when feeding compound to avoid plugging the line with chemicals.

Springfield, Mass. REYNOLD ATLAS

(*Continued on page* 118)





Control Alkalinity Through Blowdown

THIS PROBLEM of controlling alkalinity can be solved by blowdown control. Boilers are usually blown down by opening blowdown valves at certain times or by continuous blowing through small orifices. If all other factors remain constant, these periods should vary with the load on the boiler to keep a constant alkalinity in the boiler water. Assuming the load is constant, when one unit is added to the line this drops the load on each of the others; therefore the blowdown should be cut to keep boiler alkalinity from dropping. If a boiler is taken off, the line load will go up on the other units and a corresponding increase should be made in blowdown periods. Boiler feedwater alkalinity should be maintained as nearly constant as possible. If only the makeup water were treated when filling a boiler, it might be possible to get an excess of chemicals in all boilers and raise the alkalinity.

A positive alkalinity should be maintained at all times to prevent damage to the feedwater line. When a new boiler goes on the line, all blowdown valves should be closed until the desired concentration in the water is reached except for periodic blowing of sludge from bottom drum.

Birmingham, Ala. L B WHITLOW

Isolate Container From Feed Line

BASIC TROUBLE is in the water softener. Well-designed, properly operated softening equipment, suited to plant conditions, should give better water control than *HB* now appears to have. I assume he is unable to eliminate the trouble. His idea of supplying compound directly to the individual boiler feed lines is sound.

I do not recommend the arrangement in his sketch for several reasons: (1) If the chemical chamber is part of the direct feed line, as it appears to be, the large increase in volume will cause eddies and be sluggish to flow. Sludge formed at any time by the reaction of the boiler compound will tend to deposit here. This is not so bad in itself; the danger is that at some time an accumulation may be swept into the outlet line where it might lodge in an elbow or check valve. (2) Unless the feed line has a bypass not shown in the sketch, the feed must be shut off from the boiler while the chamber is filled. (3) In the construction indicated, the chamber always carries full feed-line pressure. Because of past experience, I want nothing of this sort in a feed line; it should be isolated by heavy, thoroughly reliable valves.

Dorchester, Mass. B P NEEDHAM

Add Compound to Individual Boilers

HB'S TROUBLE could result from a number of causes. He says he has difficulty maintaining chemical concentrations when taking a boiler off the line. Does he also have trouble maintaining these values when using the continuous bleed? If so, it seems likely that chemicals are getting short circuited to the continuous bleed, and not circulating in the boiler. This would tend to show that the chemical feed and continuous bleed were not installed correctly in the boiler drum. It is normal procedure to open blowoff valves in many plants when taking a boiler off the line. So it seems reasonable to assume that chemical is blown off with the sludge.

Sketch 2–*K* shows the correct method of chemical and blowoff piping in our 3-drum B & W boiler.

Water-treatment consultants advise feeding chemical to each drum, and not to a common feed line or softener. There is no doubt that this procedure can maintain close control over established limits.

Container in the feed line, as in *HB's* sketch, would no doubt work, but using his proposed method would not cure his trouble. It only maintains his chemical values without locating the reason why he cannot maintain them at all times.

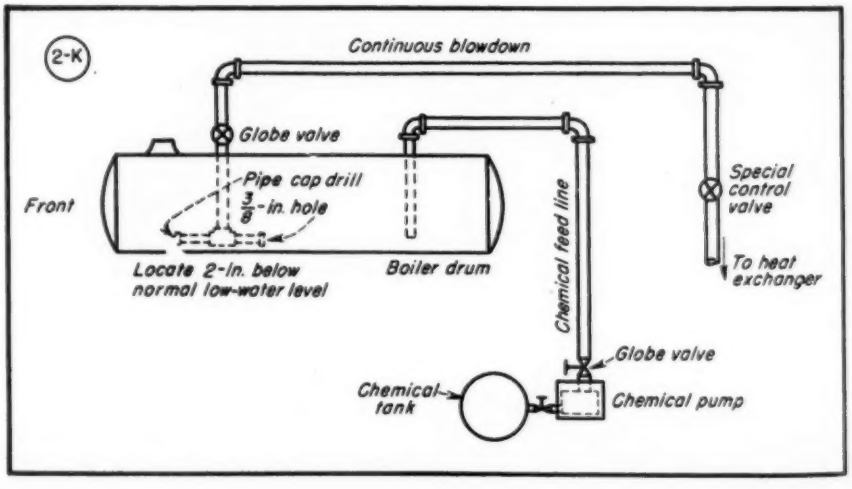
Normally, continuous bleed and chemical feed lines are of ½-in. pipe. Material depends on the chemicals used. In some cases stainless-steel pipe is necessary, in others, extra heavy iron is suitable. If *HB* is running his feedwater treatment in conjunction with a company specializing in the supervision of such work he can obtain advice that will give close and accurate results. He should not trust his own judgment.

Dolbeau, Que. R A LANE

Feed the Chemicals To Boiler Separately

HB CAN IMPROVE the control of alkalinity and phosphate in boiler water by feeding chemicals to boilers separately. Sketch 2–*J* shows one type of chemical feed bottle that has been successful in a number of plants. Size and weight of material used in construction should be fitted to boiler size and pressure. Have a sample of water from each boiler analyzed to maintain a constant check; add chemicals as necessary.

Zanesville, Ohio E L MILLIRON



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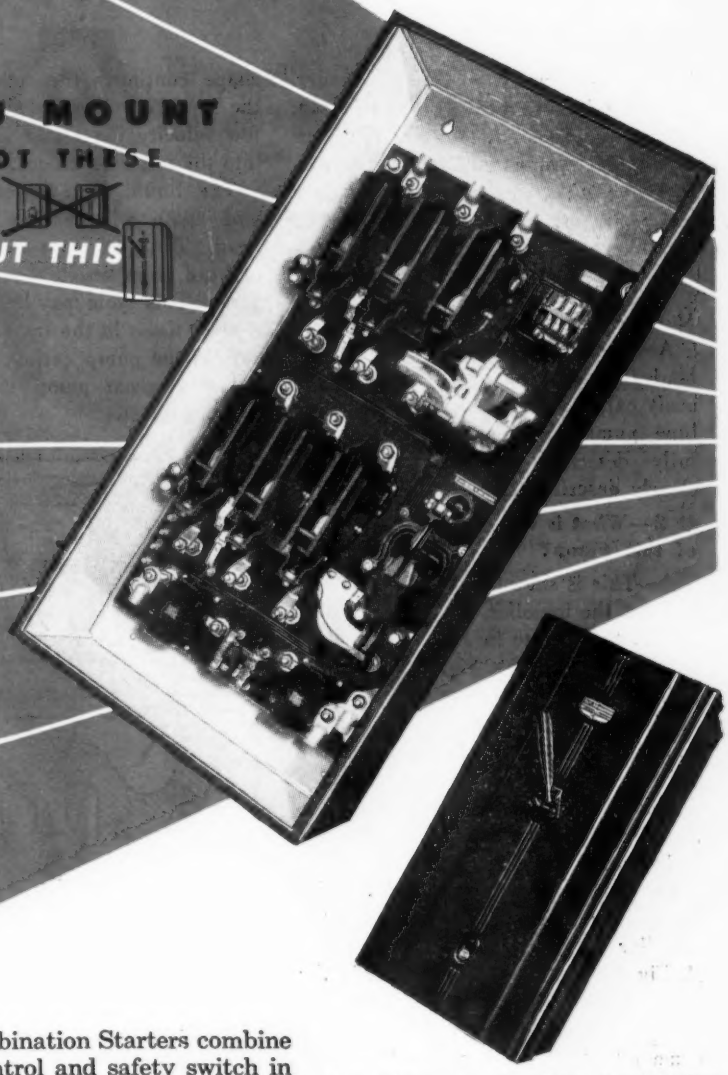

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REGENERATIVE-PUMP Q&A FOR POWER ENGINEERS

By V de P GERBEREUX

Construction, Operation and Troubles

V de P Gerbereux, assistant manager, centrifugal-pump division, Worthington, selects questions and answers that give a practical understanding of construction, operation, characteristics, troubles and remedies.

Q 1—What is a regenerative pump?

A—The term describes a small multi-bladed-impeller pumping unit, variously called a vortex, peripheral or turbine pump. None of these terms is fully descriptive; regenerative more clearly describes the unit.

Q 2—What is the operating principle of this pump?

A—This is shown in Fig. 1 to 5. Fig. 3 shows the impeller, with vanes cut in its rim that rotate in an annular channel or race chamber, Fig. 1. Liquid entering the casing flows to both sides of the impeller (in some types it actually goes through openings in the impeller's web) to give hydraulic balance and a double-suction effect. Twin passages lead the liquid to the impeller blades, as indicated.

Each casing is equipped with a dividing wall or stripper through which the impeller passes with close clearance, *A*, Fig. 2. Just beyond this wall in the direction of rotation, twin suction passages pass around the sealing wall and come into the impeller chamber as at *B*. The impeller blades pick up the liquid as it comes from the suction passage, Fig. 4, and centrifugal force throws it out to the periphery of the impeller. Liquid leaving the impeller blades has velocity energy added. The casing passage causes a gradual reduction of velocity with the accompanying increase in potential energy (pressure). Thus, the pump has generated head. In the impeller the vane-support shape is such as to cause the liquid leaving to rotate, as in Fig. 5. Casing-passage shape continues the rotary motion as the liquid's velocity decreases until at low velocity the liquid is guided back into the impeller blades.

The liquid then repeats the cycle, and again adds energy or generates head. Thus we have the regeneration of head from which the pump gets its name. This cycle may be repeated from 2 to 50 times in the travel of the liquid around the pump casing.

For a given pump the higher the head against which the pump must discharge, the more regeneration will take place. The maximum head a given pump can generate is limited by the impeller's diameter and speed.

When the liquid reaches the back side of the dividing wall it is guided out of the casing into the discharge nozzle. Fig. 2 shows the path of the liquid in three cycles around the casing. Since the impeller blades pick up any fluid, a regenerative pump can handle

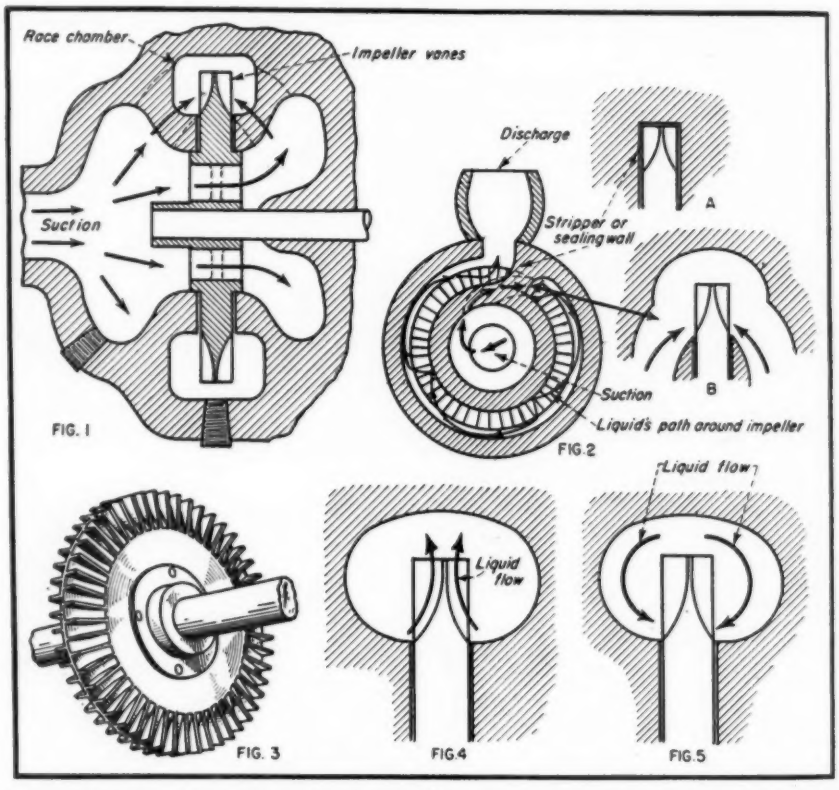

Fig 1—Cross-sections through regenerative pump. Liquid entering the casing flows to both sides of the impeller and through twin passages to the impeller blades, as indicated. Fig. 2—Each casing has a dividing wall or stripper through which the impeller passes with close clearance as at A. Just beyond this wall in the direction of rotation the twin suction passages, which pass around the sealing wall, come into the impeller chamber as at B. Fig. 3—Impeller for a regenerative pump. Figs. 4 and 5—These diagrams indicate how fluid rotates in the race chamber and between the vanes of a regenerative pump

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vapor as well as liquid as long as there is sufficient liquid to seal the space between the impeller and the sealing wall of the casing.

Q 3—Why is the regenerative pump self-priming?

A—Blade pockets of the impeller passing the suction entrance to the race chamber pick up whatever is flowing in through the suction passage. If this is vapor, the blades carry it away the same as if it were liquid. As long as the clearance between the suction and discharge is sealed, the pump continues to pick up vapor or air from the suction line until it is primed. To avoid loss of sealing water during shutdown periods suction traps are used as in Fig. 6. Time required for priming depends upon the quantity of air or vapor that must be displaced. On a 6-ft lift a regenerative pump will prime in, possibly, 30 sec, whereas on a 20-ft lift it might require 3 to 4 min.

Q 4—What happens when the pump handles vaporizing liquid?

A—Since its impeller blades pick up any fluid, a regenerative pump can handle vapor as well as liquid as long as there is sufficient liquid to seal the space between impeller and casing sealing wall. Pump capacity will equal liquid volume, plus vapor volume entering the impeller. Because pumping compresses the vapor, pump capacity measured at the discharge is less than at the suction. The discharge nozzle, Fig. 1 and 2, has greater area than the suction. This difference facilitates vapor and liquid separation and allows the latter to drop back into the pump for sealing during priming, thus contributing to its self-priming quality.

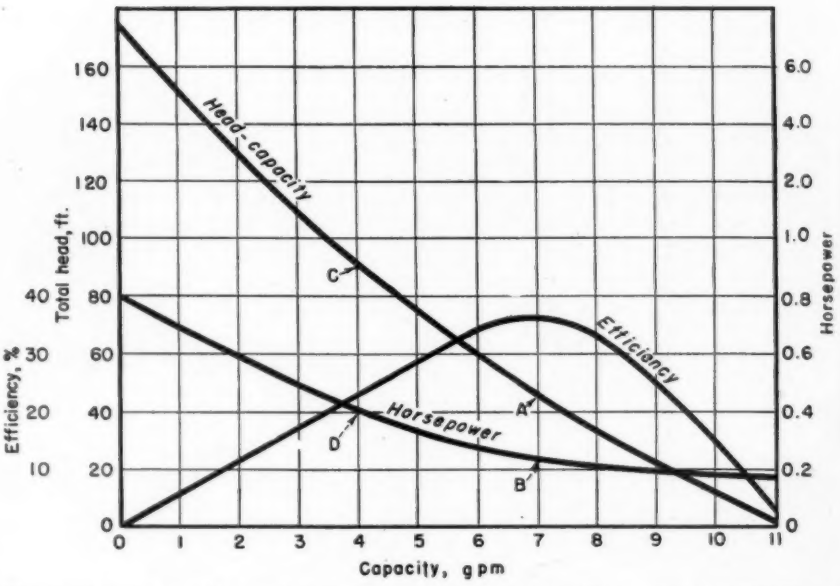


Fig. 7—Head capacity and horsepower of a regenerative pump increases as capacity decreases. Head is four times as high at shutoff as at rated capacity

Q 5—What is the shape of the charactertistic curve?

A—Fig. 7 shows that head-capacity and horsepower curves rise steeply with a reduction in capacity. For example, at 7 gpm, the point of best efficiency, the pump develops 45-ft head, point *A*, and requires about 0.25 hp to drive it, point *B*. If the pump is throttled to 4 gpm, the head increases to over 90 ft, point C, and the power to 0.4 hp. At shutoff the head increases to 175 ft, nearly four times that at best efficiency, and power reaches 0.8 hp.

Q 6—How are regenerative pumps selected?

A—When selecting such a pump consider maximum head against which it will operate, and choose a drive unit for the power corresponding to that head. If there is danger of the pump operating against closed discharge or other capacity restriction, use a relief valve or pressure cutoff to prevent pressures that would overload the driver.

Q 7—What major precaution must be taken in their application?

A—There are a number of factors which make these units unsuited for certain services. Before selecting for a given application, consider the following questions:

a. If the fluid is corrosive will it build up the running clearances and cause

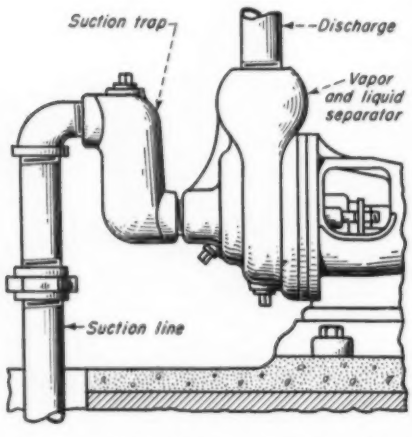


Fig. 6—Suction traps prevent sealing-fluid loss to reduce priming time

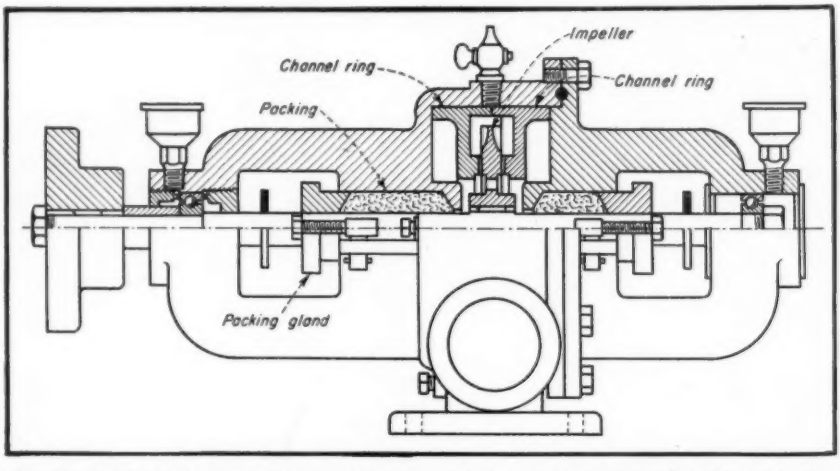
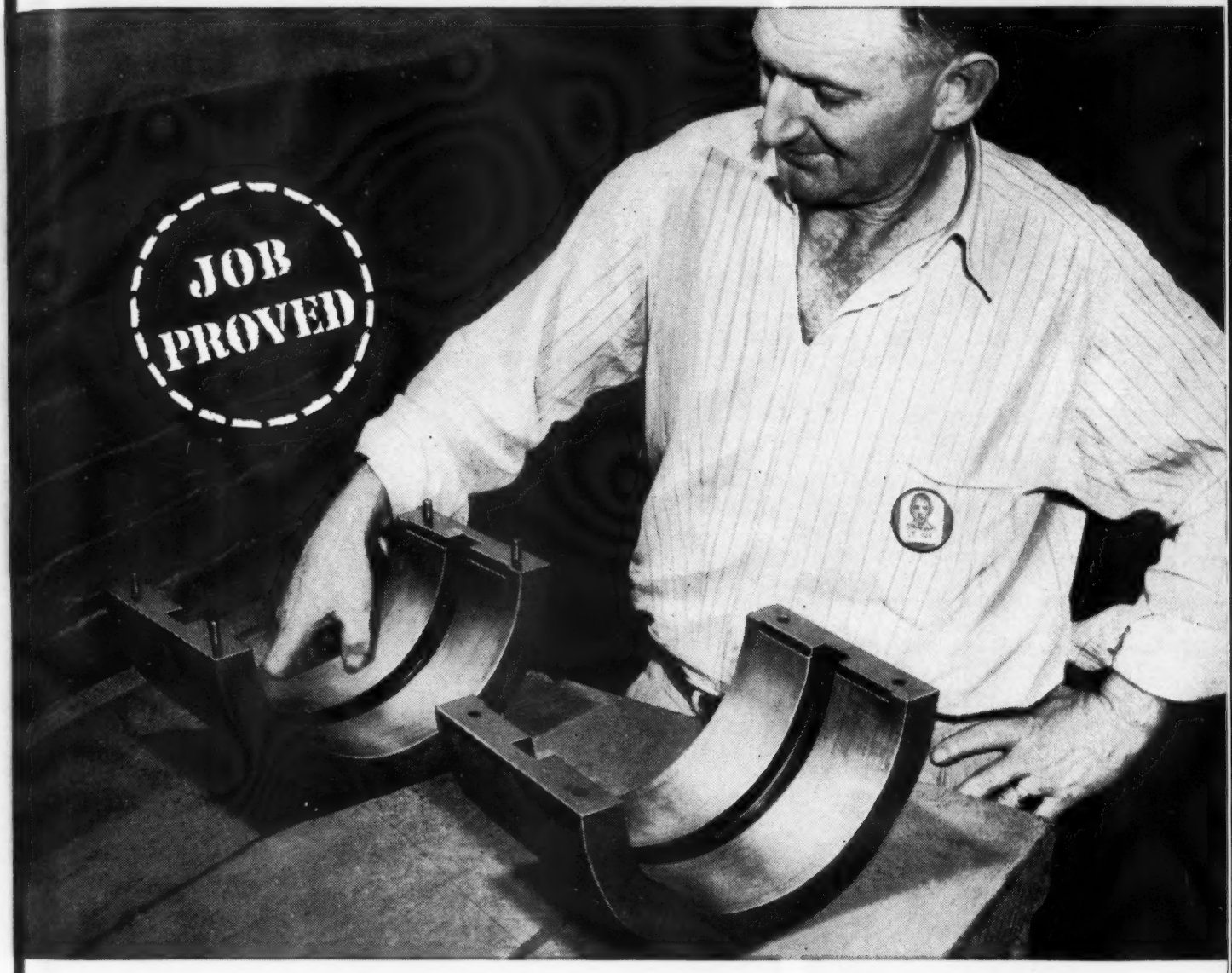


Fig. 8—Cross-section of regenerative pump with suction and discharge connections in bottom of casing and with two outside bearings and two stuffing boxes

Keeps His Bearings



SUN LUBRICANT . . .

Keeps Compressor's Main Bearings and Other Parts Like New for 20,000 Hours

The 400 horsepower, V-type, diesel-driven compressor in an Eastern shipyard operates normally on a 24-hour-a-day schedule. It has been lubricated with a Sun "Job Proved" oil from the day it was installed, and there has never been any lubrication trouble.

After 20,640 hours of almost continuous operation, the compressor was torn down for inspection. The main bearings, shown above, were checked and found to be in fine condition, with less than normal wear. All other parts were in the same state—practically as good as new.

The protection given to this compressor is typical of the results obtained in hundreds of plants with Sun "Job Proved" lubricants. For every type of modern power plant equipment, there's a Sun oil that's designed to give long, trouble-free service.

To reduce maintenance costs and to keep your diesels, turbines, compressors and other machines in operation longer, let Sun Engineers prescribe the correct lubricants. Call your nearest Sun office, or write Department P-9.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***
In Canada: Sun Oil Company, Ltd. — Toronto and Montreal

SUN
SUNOCO
INDUSTRIAL
PRODUCTS

the pump to seize, or will it attack the metal at the running clearances and cause them to wear rapidly?

b. Is there grit or other foreign material in the liquid which will cause the pump to seize or wear rapidly?

c. Is the service a wet and dry type where air in combination with wet clearance surfaces will cause corrosion or crystals?

d. Is the service long term? At best, a regenerative pump gives from ¼ to 1/3 the life of a centrifugal pump operating under comparable conditions. Use spare units more generously with regenerative types.

If the service and requirements pass these limitations, regenerative pumps can be used. But, if possible, select a pump with over-capacity for the job so that after some wear it will still have the desired discharge. When handling a liquid that contains vapor in suspension, discharge volume is only that of the liquid. For example, a 10-gpm pump, handling 60% liquid and 40% vapor, will discharge only 6 gpm of liquid; therefore, select a pump that is oversized for the application (perhaps two to three times the stated gpm), and power it for all liquid operation, even though it will take less power when pumping vapor.

Q 8—What is the life of these pumps?

A—Under normal service, handling clear liquids, they should have a life of 3 to 4 years before their clearances have to be renewed.

Q 9—What materials are used?

A—Most regenerative pumps have a bronze impeller and cast-iron side plates or heads. They can, however, be furnished with bronze impeller and bronze side plates, with a cast-iron casing. They also are generally available in all iron and all bronze constructions. Sometimes they have been made of stainless materials but the increased clearances required with stainless steel reduces their possible uses.

Q 10—What is their useful range?

A—As a rule, they are used for capacities from 1 to 100 gpm, and heads to about 500 ft, but most of them are for 50 gpm, or less. Some manufacturers have sizes available up to 200 gpm and up to 1200-ft head.

Q 11—What are their charactertistics at variable speed?

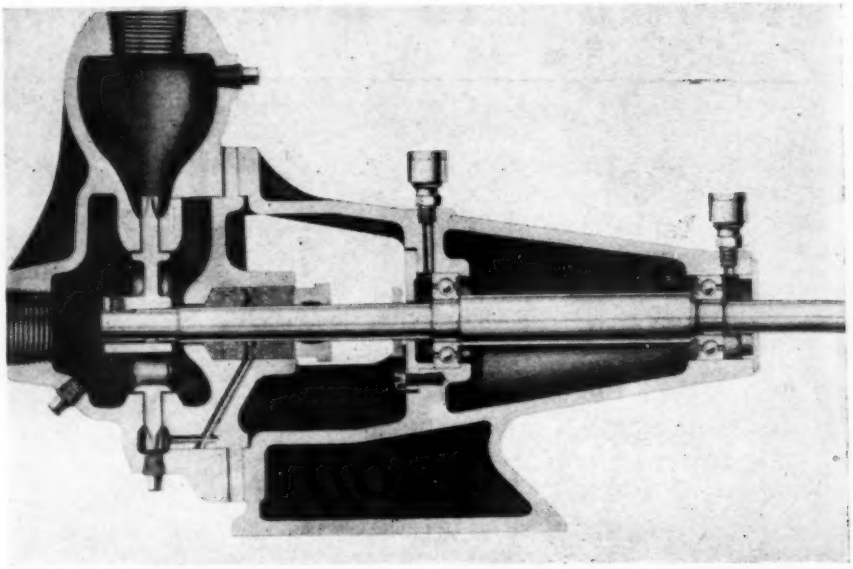


Fig. 9—Pedestal-mounted and overhung regenerative pump with two outside antifriction grease-lubricated bearings and one stuffing box with lantern ring

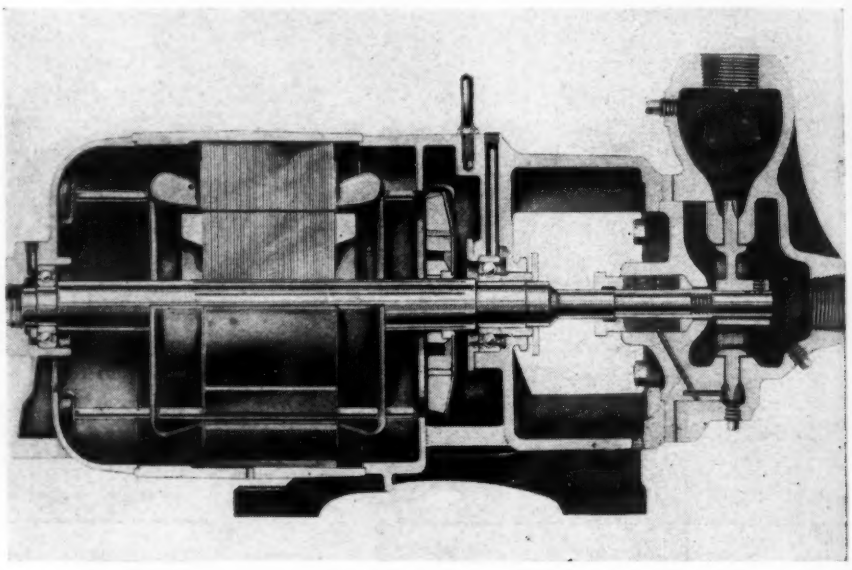


Fig. 10—Regenerative pump, mounted on extension of motor's end frame, requiring minimum space similar to the close-coupled centrifugal pump

A—A regenerative pump follows the same head-capacity speed law as a centrifugal pump; namely, capacity varies as the speed, head as the speed squared, and power input as the speed cubed.

Q 12—What are their major advantages?

A—Regenerative pumps develop higher heads per stage than centrifugal designs. They are, therefore, particularly applicable for small capacities where a centrifugal pump would operate too close to shutoff to be satisfactory. They have a steep head-capacity curve giving almost constant capacity over a wide range in head. They are inherently self-priming, and so handle vapor as well as liquid where necessary. Their cost is considerably lower than for pumps of equal head-capacity range for which regenerative turbine pumps are suited.

Q 13—How is the pressure distributed in the pump casing?

A—Pressure increases around the race chamber at about a constant rate. It is about 25% of discharge value at one quarter the distance from suction to discharge, 50% at the halfway point, and 75% at the three-quarter point.

Q 14—What constructions are used?

(*Continued on page* 160)

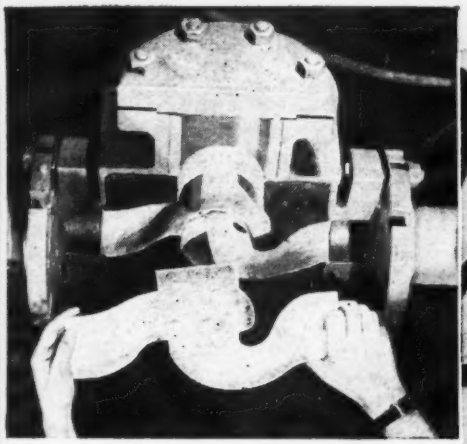
PROVED! More Flow, Less Pressure Loss *with* NEW Edward STEEL VALVE DESIGNS

To be *sure* that Edward engineers were on the right track in their efforts to cut pressure loss and wear-producing turbulence and to increase flow in new steel valve designs, the Edward laboratories set up an entire new set of research procedures and developed a whole range of new test equipment, much of it not duplicated anywhere.

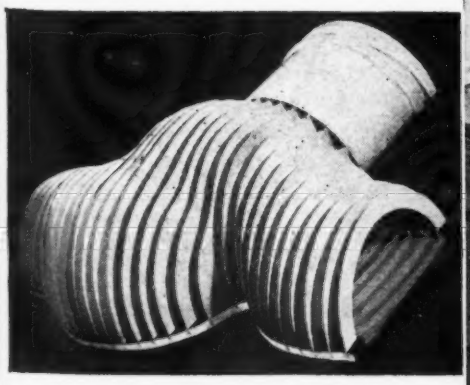
So there's no guessing in the statement that you get up to 30 per cent more flow through new Edward steel valve designs. There's proof aplenty—the evidence of actual field operation and cross-checked laboratory tests . . . the cold facts of pure mathematics, and even the convincing testimony of visual pre-testing.

Here you see plaster casts shaped by half-section plastic valve models. Each model, molded in a steel box and frozen hard, has been flow-tested to develop ideal flow contours. To compute flow test results Edward technicians even developed completely new slide rules, like the one shown. The plaster casts serve as masters from which sectional models and then the actual patterns for Edward valve castings are developed.

No valve series has ever been designed with more extensive flow research . . on no other valves is there more proven flow data.



Half section super-streamlined Edward globe valve of plastic is used in flow tests. After ideal contours for high volume and minimum turbulence are established, casts are made of flow passages.



From actual plaster casts, checked against mass of flow data, model cross section templates are built. These guide design of patterns for Edward steel valve body castings.

Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO.

EAST CHICAGO, INDIANA

MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

Freehand Figuring—3

▶ HERE ARE some more examples of freehand figuring—approximate, high-speed arithmetic. While studying these samples never forget their purpose. There are times and places where meticulous accuracy is either a complete waste of time or not worth the special effort required.

That's where these methods fit in—where an answer within 5 or 10% is needed in a hurry, and where there are no tables, slide rules, or even pencil and paper.

The speed angle is particularly important in preliminary discussions of various plant possibilities.

The ability to figure fast in this freehand style is a priceless asset when an engineer is discussing proposals and ideas with top business executives. Many a false line of reasoning can be blocked in the air, like a football punt, by the engineer who is fast with figures.

So here goes for some more practice in fast and furious arithmetic—*to be done without touching pencil or paper.*

Let's start with problems involving cylinders (pipes, wires, tanks, rods): The volume of a cylinder is the length times the area of the cross-section circle. The circle area is diameter squared times 0.785. In this work never carry this beyond 0.78, and whenever safe and more convenient substitute 0.80 or 0.75.

Example (Fig. 1): Estimate the weight of a $1\frac{3}{8}$ in. round brass rod, 17 ft long.

Since $1\frac{3}{8}$ is 1.375 you may be tempted to square 1.375, but don't do it. Here it's easier to work with $1\frac{3}{8}$ when you see that $1\frac{3}{8}$ squared is 121/64—a little less than 2.

Since 2 is a little high, multiply it by 0.75 (a little low) to get the approximate section area, 1.5 sq in.

The 17-ft length is about 200 in., so the approximate volume is $200\times1.5=300$ cu in. Taking the unit weight of brass as 0.3 lb per cu in., the total weight of the rod is about 90 lb.

Example (Fig. 2): Estimate weight 250-ft length No. 16 bare copper wire.

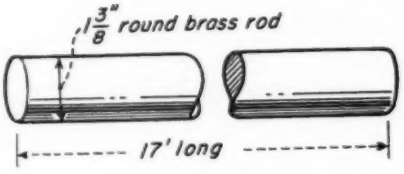


Fig. 1 - weight = ?

Fig. 2 - weight = ?

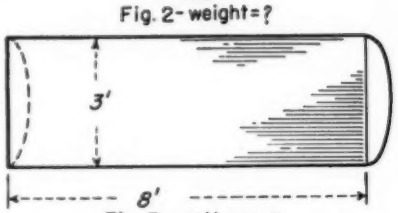


Fig. 3 - gallons = ?

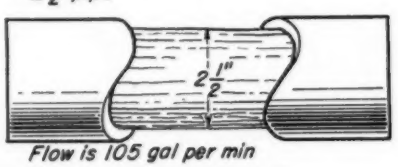


Fig. 4 - water velocity = ?

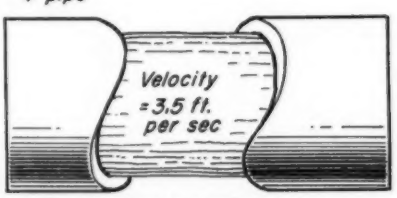


Fig. 5 - gallons per minute = ?

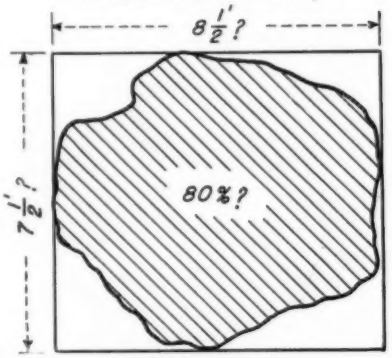


Fig. 6 - area = ?

Diameter of No. 16 is 51 mils. Call it 0.050 in., or 1/20 in. Then diameter squared is 1/400. This times 0.8 is 0.002 sq in.

To get the number of inches in 250 ft divide 12 by 4 and multiply by 1000. Answer is 3000 in. Then $3000\times0.002=6$ cu in. At 0.3 lb per cu in. the wire weighs about 2 lb.

Example (Fig. 3): What is the gallon capacity of a cylindrical tank 3 ft in diameter, and 8 ft long in the straight part, if one head is concave and the other convex?

The convex and concave heads just cancel, so the capacity is the same as that of a flat-headed tank, 8 ft long. Diameter squared is 9. This times 0.8 is 7.2. Call it 7 sq ft. Then $7\times8=56$ cu ft.

Gallons capacity $=56\times7.5$. Note that 7.5 is three-quarters of 10, so cut one quarter off 56 to get 42, and multiply this by 10 to get 420 gallons.

Example (Fig. 4): What is the velocity of water in a 2½-in. pipe delivering 105 gal per min?

One gallon is 231 cu in. so delivery is about $230\times100=23{,}000$ cu in. per min. This is about $24{,}000\div60=400$ cu in. per sec.

Square of 2½ is about $2\times3=6$. This times 0.8 is 4.8. Call it 5 sq in. Then water velocity is $400\div5=80$ in. per sec, or $80\div12=$ about 6 or 7 ft. per sec.

Example (Fig. 5): How many gallons per min will be delivered by a 4-in. pipe if the water velocity is 3.5 ft per sec?

Section area is $4\times4\times\frac{3}{4}=$ about 12 sq in. Distance water flows per min is $3.5\times60=7\times30=210$ ft. Cubic inches delivered per min $=12\times12\times210=144\times210=$ about $150\times200=30{,}000$.

Since one gallon is 231 cu in., the gallons per minute are $30{,}000\div231=$ about $3000\div24=1000\div8=125$ gal per min.

Example (Fig. 6): Approximate the area of the irregular shape in the diagram if the estimated length is about 8.5 ft, the estimated width about 7.5 ft, and if the shape seems to fill about 80% of the rectangle. Then the approximate area is $0.8\times8.5\times7.5=$ about $0.8\times8\times8=$ about 50 sq ft.

Delaware Hospital, Wilmington, Delaware

Heated by 6-zone Webster Moderator System of Steam Heating. Completed in 1942. Unit No.1, center, occupied in 1940. Architects: Massena & duPont, Wilmington. Consulting Engineers: Jaros, Baum & Bolles, New York. General Contractor: Turner Construction Co., Philadelphia. Heating Contractor: Benjamin F. Shaw Co., Wilmington.

3 Trap Replacements in 7 Heating Seasons

When a hospital spends in the neighborhood of $30,000 annually for fuel oil, that's big business. It calls for a "controllable" steam heating system and careful heating plant operation to effect maximum economies.

The outstanding heating record of the new Delaware Hospital began with a Webster Moderator System designed by the well known New York engineering firm of Jaros, Baum and Bolles. It included installation by a competent heating contractor.

Continuity of operating experience is provided by Chief Engineer Carl A. Baehr, who has been with the new Delaware Hospital from the beginning. Let Mr. Baehr tell you about some of the heating economies.

"Out of 1,981 Webster Radiator Traps in use, only three have required new thermostatic interiors in seven years of service. The Webster Radiator Supply Valves have been completely satisfactory.

"We receive no more than six legitimate heating complaints a year, and correction is always promptly made.

During fuel rationing we effected a number of operating economies. Stairway radiators were turned off. Radiators in the clinics, X-ray laboratory, solariums and business office were shut down at 4 p.m. and turned on at 8 a.m. This manageability is characteristic of modern steam heating systems.

"Sometimes an unusual amount of heat is required in a particular room for a limited time. Instead of turning the Variator to full heat with consequent overheating of other rooms, we remove the Webster Metering Orifice from the radiator supply valve in less than three minutes. Later it is replaced."

The Delaware Hospital was only partially completed at the time fuel rationing went into effect. It was estimated that the completed Hospital would require 620,000 gallons of fuel oil per year. Based on this estimate, the fuel rationing board allotted 500,000 gallons of oil per year for all purposes—heating, sterilizers, laundry, kitchen equipment.

Fuel consumption records show that the Hospital did not require a supplementary ration at any time during fuel rationing. The Webster Moderator System saves fuel by keeping radiators comfortably warm. Instead of 212 degrees, the average surface temperature of radiators is 185 degrees, 150 degrees or even as low as 90 degrees, depending on the need for heat.

Let Webster experience help you in your heating system management problems. The service of long-time Webster Representatives and the performance record of proven Webster Heating Systems is a combination that means comfort and economy.

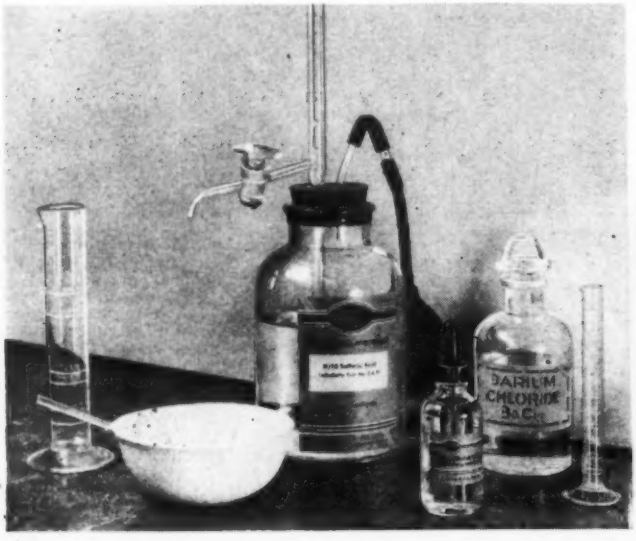
WARREN WEBSTER & CO., Camden, N. J.
Representatives in principal U. S. Cities :: Est. 1888
In Canada, Darling Brothers, Limited, Montreal

WEBSTER
MODERATOR
CONTROL
"Control-by-the-weather"

HOW TO MAKE HYDRATE ALKALINITY TEST

By M E REINER, *Technical Division, E F Drew & Co Inc*

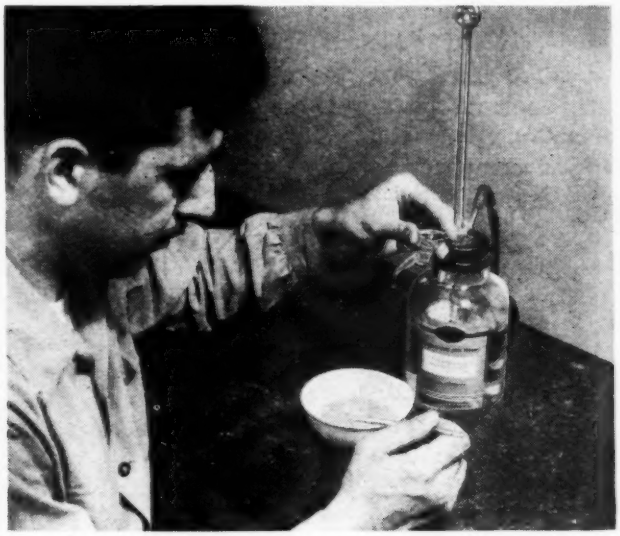
► HYDRATE ALKALINITY, caused by the presence of hydroxyl ions, may be introduced into water by the lime-soda softening process or the use of other alkalies. Ordinarily, the usual phenolphthalein and methyl orange alkalinity tests are used for control purposes. But if water contains appreciable organic material, such as decayed vegetable matter, sugar or tannin, interference may occur. Here the hydrate alkalinity test is valuable. It is also useful as a boiler-water test, especially where color interferes. Procedure below is accurate within 10%. Another method employs strontium chloride to remove the carbonate; it is accurate within 1 to 2%.



1 Apparatus and reagents for test are: two graduated cylinders (100 and 10 ml), porcelain casserole, stirring rod, 10% barium-chloride solution, N/50 hydrochloric or N/50 sulphuric acid, burette and phenolphthalein.

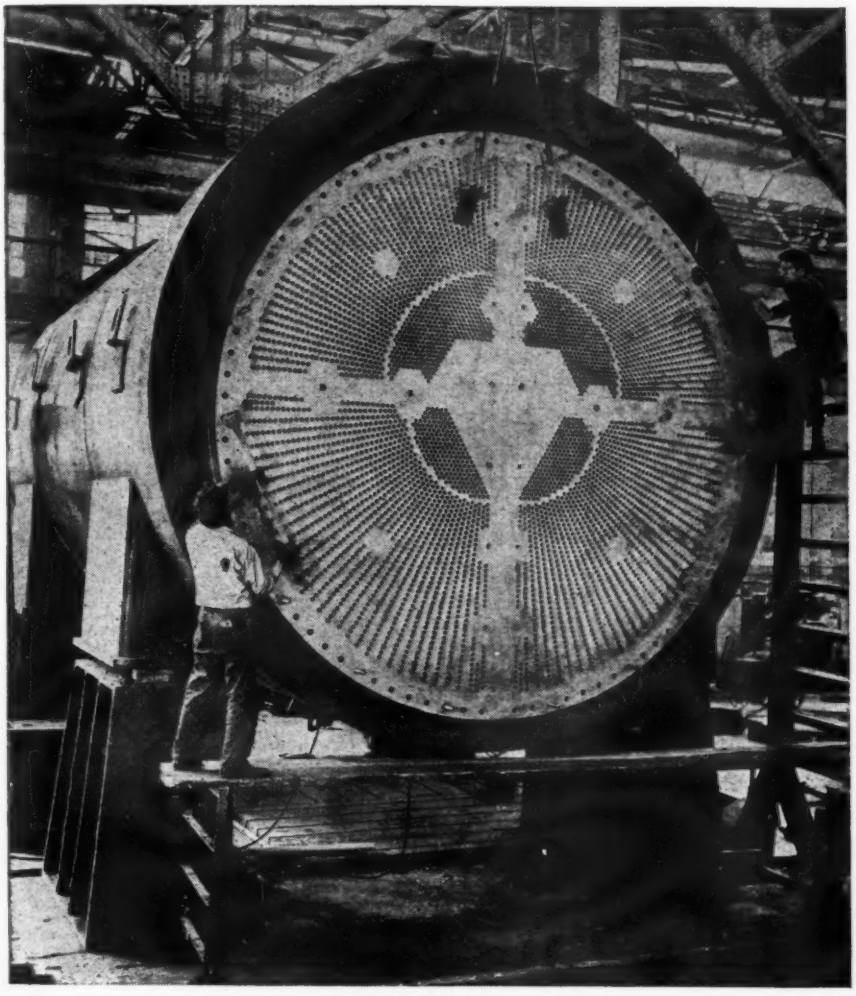
2 Measure 100 ml of the water to be tested, and transfer it to casserole. Add 5 ml of barium chloride solution and stir. This reagent precipitates the sulphates and carbonates leaving only the hydrate to be titrated.

3 Add 3 or 4 drops of phenolphthalein indicator to sample; stir thoroughly. If there is no color change, the hydrate alkalinity is not present and is recorded as zero. If a pink or red color appears, prepare to titrate.



4 While stirring, add acid drop by drop to the endpoint. Disregard return of color after a few seconds. Calculation: Ml of acid x 3.4 = hydrate alkalinity in ppm as —OH. Ml of acid x 10 = alkalinity as calcium carbonate.

★16,280 pounds of Anaconda Copper Tube Sheet go into this Westinghouse Condenser



WORKMEN are shown installing one of two 8,140 lb. copper tube sheets in a giant condenser being built by the Westinghouse Electric Corporation of Philadelphia, Pa. for the Public Service Company of Oklahoma, Tulsa, Oklahoma. The plates for these tube sheets, measuring 12′ 9″ high and 1⅜″ thick, were produced at the Detroit Mill of The American Brass Company. The completed condenser will contain 5,200 tubes—and will have a 32,500 sq. ft. capacity.

Anaconda Electrolytic Tough Pitch Copper is desirable because of the high alkaline content of the Tulsa water supply.

Anaconda Rolled Plates and Circles for condenser tube sheets are unsurpassed in soundness and close grain structure. They can be supplied in rectangles, squares, circles, ovals, segments and sectors thereof. Plates are regularly manufactured in widths up to 156″ (circles up to 160″ diameter) and in weights up to 9,000 lb. and heavier—depending on the alloy and shape.

In determining the most suitable alloys for tubes and tube sheets, equipment manufacturers are invited to consult our Technical Department. Publication B-2 available on request.

ANACONDA
from mine to consumer

Anaconda

COPPER & COPPER ALLOYS

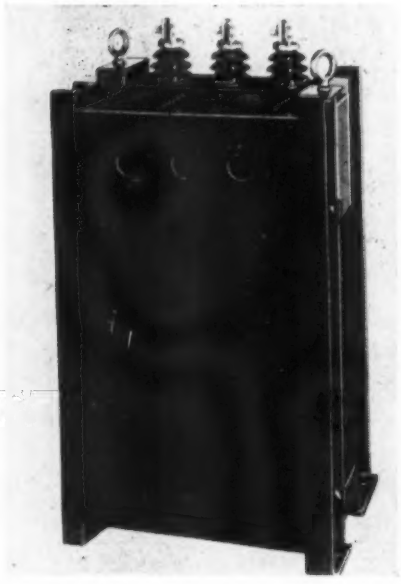
THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

WHAT'S New IN PLANT EQUIPMENT



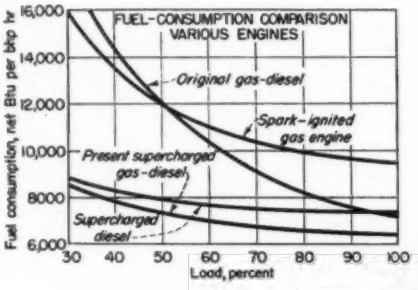
Air-Cooled Transformer E1

USING CLASS B INSULATION THROUGHOUT, this dry distribution-transformer includes such inorganic insulation as fiber-glass, mica and asbestos. It has improved natural draft and a more compact built-in, low-voltage wiring compartment for conduit wiring. The elimination of messy liquids permits economical indoor installation at load center without a fireproof vault. Designated as Type *S*, these transformers are available for single- and 3-phase installations up to 100 kva in voltages up to 4800. **Marcus Transformer Co, 32 Montgomery St, Hillside 5, New Jersey.**

Voltage Regulator E2

THIS LOW-COST general-purpose portable ac voltage regulator features electronic control circuits and is designed specifically for applications on electrical equipment utilizing light loads. Designated as *Model* 150, the regulator has an input voltage range of 95 to 125 v, ac, with an output of 115 v. Regulation accuracy is one-half of 1% and maximum harmonic distortion is 5%. Other important features include a load range of 10 to 100%, frequency range of 50 to 60 cycles, and a power factor range of 70% lagging to 90% leading. Maximum recovery time is six cycles.

Extremely adaptable to a wide range of equipment, *Model* 150 is ideally suited for use with electrical apparatus that needs good regulation at low cost. Some of many applications for the new model are laboratory apparatus, production and quality control test equipment, high-frequency oscillators for regulation of filament and plate supply and photometric apparatus. The unit is mounted in a gray enamel case and measures only 9x7½x6 in. **Sorensen & Co, 375 Fairfield Ave, Stamford, Conn.**



Improved Gas-Diesel E3

SIGNIFICANT DESIGN DEVELOPMENT in Cooper-Bessemer gas-diesels makes it possible to guarantee fuel rates lower than those of similar diesels even at part loads. Designers have sought to improve the efficiency at low loads, ever since the introduction of this general engine type, which compresses a mixture of gas and air to diesel pressures, can change from oil to gas operation under load, and can operate on combinations of oil and gas. Normally such engines show low fuel consumption at full load, but the fuel-rate curve is not essentially flat like that of a diesel. Fuel consumption increases markedly at partial loads, the curve being more like that of a spark-ignited gas engine.

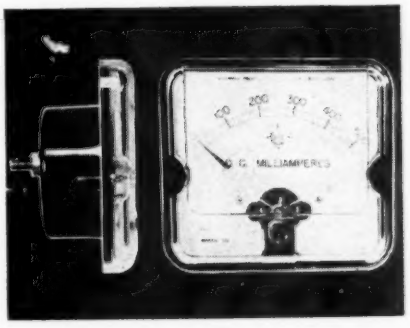
Design changes in the Cooper-Bessemer line of gas-diesels correct this condition and produce, for a supercharged engine, a gas-diesel fuel-rate curve that is essentially flat like that of a supercharged diesel. As the graph above shows, the fuel-rate curve of the new supercharged gas-diesels is lower at all loads than that of their supercharged diesel and markedly superior to the curves for the original gas-diesels and for spark-ignited gas engines, particularly at low loads. **Cooper-Bessemer Corp, Mt. Vernon, Ohio.**

Clamp Supports E4

MADE OF TOUGH PLASTIC with great tensile and impact strength, plastic clamp supports are for mounting wires, cable, tubes, pipes, rods, hose, etc. Compared to metal, these supports are excellent insulators and thus give added insurance against short circuit. They withstand extreme temperature changes of from —78 F to 180 F. They are unaffected by atmospheric conditions and prevent corrosion and sweating. Since material is pliable, the support opens to any dimension to slide over wires, pipes, tubes, etc. **Holub Industries, Inc. Sycamore, Ill.**

Outlet Box E5

MODEL 3001-A multiplug outlet box solves problem of coping with an insufficient number of small outlets. Unit contains eight standard receptacles and can be plugged into any convenient wall outlet of 110-125 v ac or dc. It also has a convenient neon pilot light that distinguishes ac from dc and signals when voltage is on. A built-in toggle switch breaks both legs of line, and two 15-amp fuses protect line from overload. Unit is built into a cabinet 3x4x5 in. All component parts are approved by Underwriters Laboratories. **Allied Laboratory Instrument, Inc, 355 W 26th St, New York 1, N. Y.**



Panel Meter E6

TO PROVIDE a better-looking meter, a crystal-clear plastic case is used on this 3¾-in. panel instrument. This construction gives more usable scale space, and permits more light to reach the dial for easier reading. Dial is also furnished in color to harmonize with your equipment. Meter is readily illuminated from front or rear. Light played on back of case will pipe through the plastic to cast soft illumination on dial.

Both moving coil and repulsion iron-vane elements can be supplied. These meters are also built in rectifier type and thermocouple high-frequency and pyrometer instruments. All popular ranges of volts and millivolts as well as milliamperes and amperes for ac and dc are furnished. Specially designed Alnico magnets are

To secure additional information on these new equipment items, use convenient reply cards on page 190A. Please be sure to identify your request with the new equipment key letter and number, as shown on the items above.

Steam . . . water . . . oil . . . or gas
CRANE Supplies all Piping equipment

. . . A good thing to remember for a simplified piping job every time . . . on new or replacement installations. No matter what the fluid or working conditions, see the Crane line first for *all* piping equipment . . . and for dependable quality in every item.

For this water supply system, for example, the Crane Catalog puts everything at your finger tips . . . valves, fittings, pipe, and pipe line accessories. One order to your Crane Branch or Wholesaler covers all your needs. From design to erection to maintenance, your piping job moves fast and smooth . . . with good performance assured . . . because you get this 3-way advantage:

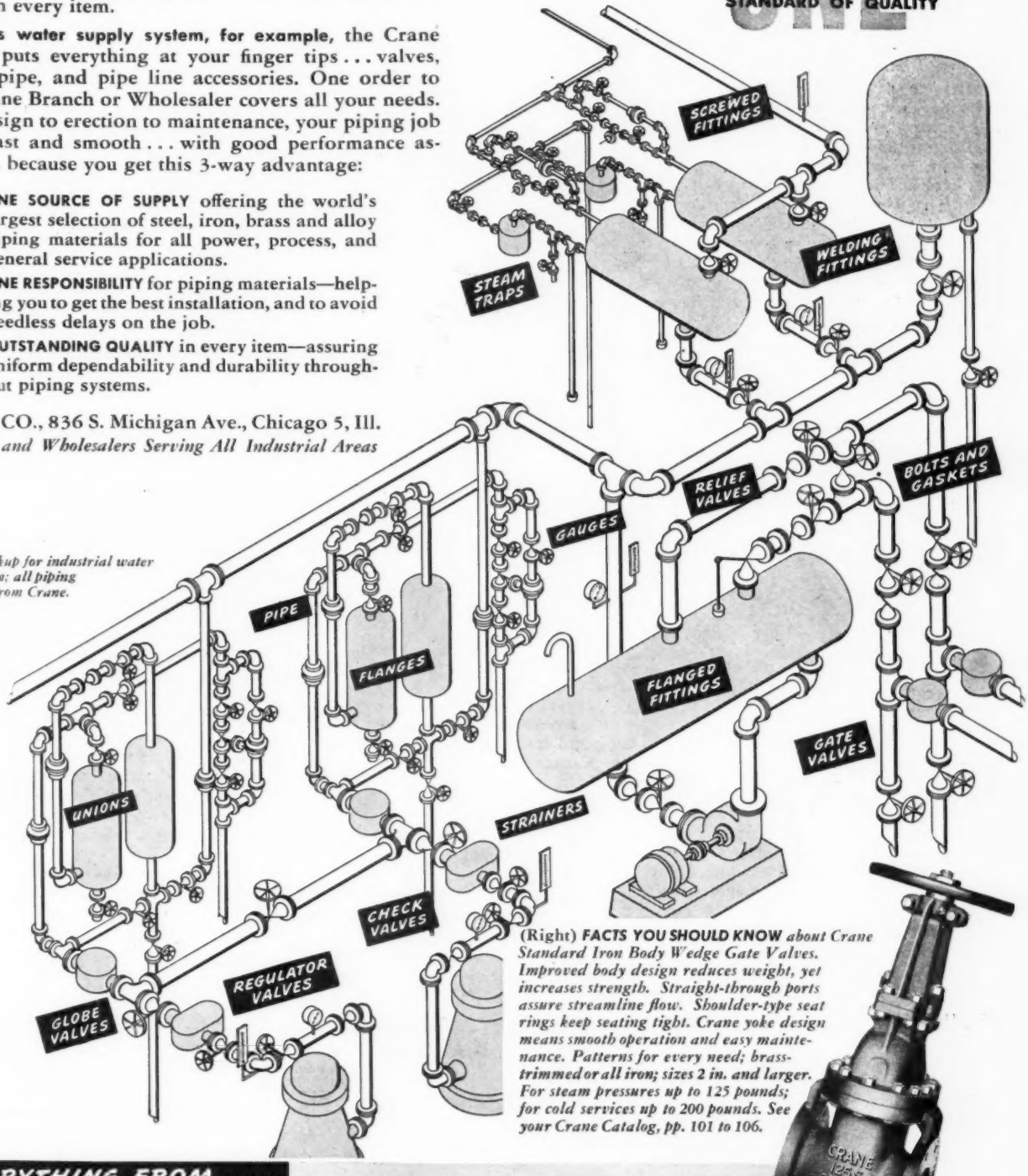
ONE SOURCE OF SUPPLY offering the world's largest selection of steel, iron, brass and alloy piping materials for all power, process, and general service applications.

ONE RESPONSIBILITY for piping materials—helping you to get the best installation, and to avoid needless delays on the job.

OUTSTANDING QUALITY in every item—assuring uniform dependability and durability throughout piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Typical hookup for industrial water supply system; all piping equipment from Crane.

(Right) **FACTS YOU SHOULD KNOW** *about Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight, yet increases strength. Straight-through ports assure streamline flow. Shoulder-type seat rings keep seating tight. Crane yoke design means smooth operation and easy maintenance. Patterns for every need; brass-trimmed or all iron; sizes 2 in. and larger. For steam pressures up to 125 pounds; for cold services up to 200 pounds. See your Crane Catalog, pp. 101 to 106.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

Equipment *Continued*

used for ultra-sensitive micro ammeters.

Meter measures 3¾ in. wide by 3⅜ in. high and extends less than ⅝ in. in front of mounting panel. **Assembly Products, Inc, Main and Bell St, Chagrin Falls, Ohio.**

Test Cabinet E7

TESTMASTER CABINET contains the apparatus and chemicals needed to perform feedwater control tests. Individual clamps and supports for securing each item of glassware are easily adjustable; they may be moved and interchanged so as to position the apparatus at will for any combination of tests. An extendable tray provides additional working space and writing surface to enter calculations. Tray slides back under cabinet when not in use. **TruTest Laboratories, Inc, 20 S 33rd St, Philadelphia 4, Pa.**

Water-Level Controller E8

MICRO-NETIC ELECTRIC CONTROLLER embodies a round ball float of monel capable of resisting a pressure of 400 psi. Float carries a steel ring that attracts a set of magnets when the ring comes into their field. The *Alnico* permanent magnets are capable of lifting 100 times their own weight. **J A Campbell Co, 645 E Wardlow Rd, Long Beach 7, Calif.**

Welding Flux E9

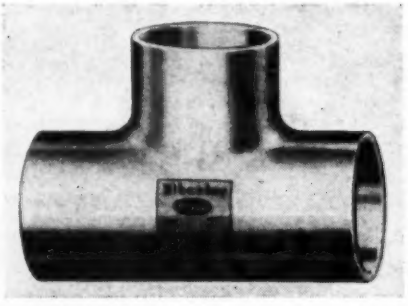
NEW PASTE serves as an iron flux for gas welding. In application, the paste is painted on clean surface of the cast iron while the casting is cold. It can be used in repair of broken castings, salvage of defective parts, repair of pitted cast-iron molds and correction of machine shop errors. It is known as All-State No. 1*A* cast-iron flux. **All-State Welding Alloys Co, 96 W Post Rd, White Plains, N. Y.**

Automatic Burette E10

TRUTEST E-Z-C AUTOMATIC BURETTE is available in 10- and 25-ml sizes. It is resistant to chemical action of alkaline and acid solutions. Inner column is manufactured from a special heat-fired yellow tubing, which forms a perfect background for the burette reading, and projects a sharp, clear, straight hairline meniscus, thereby increasing accuracy of the burette. **TruTest Laboratories, Inc, 20 S 33rd St, Philadelphia 4, Pa.**

Cooling Tower E11

NEW AQUATOWER is designed to answer demand for a compact cooling tower of modern design with a high performance rating in the air-conditioning and refrigeration field. Unit is sent out as a packaged product, ready for operation. Sizes run from three to 15 tons of refrigeration capacity. Unit is engineered for indoor or outdoor service, and is available with or without pump. All component parts are readily accessible for servicing and a sturdy fan guard insures safe operation. **Marley Co, Kansas City 15, Kan.**

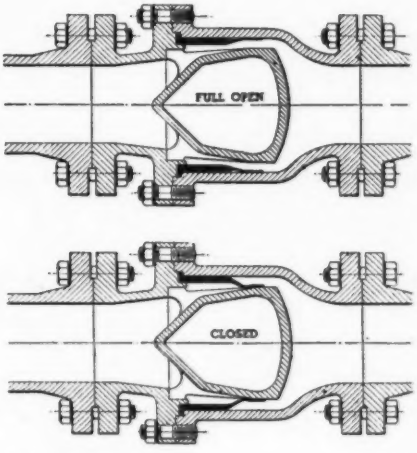


Pipe Fittings E12

NIBCOLOY WROT FITTINGS serve where corrosion and turbulence are a problem. These pipe fittings are available in Inconel, nickel and monel, and in stainless steels 304, 347 and 316. A lock ring presents a simple and efficient method of joining with silver brazing or soft solder. Joint may also be butt welded. A complete range of sizes is available from ¼ to 4 in. OD. Each fitting is individually identified by a permanent metal tag welded in place, which gives necessary information to facilitate exact matching of metallurgical and physical characteristics of pipe and fittings. **Northern Indiana Brass Co, Elkhart, Ind.**

Strainer E13

NEW Y-TYPE STRAINER, available in pipe sizes from ¼ to 2-in., is made of cadmium-plated rust-resisting cast iron or all bronze. It is built around 250-psi standards for cast iron and is suitable for 400-psi service when finished with bronze body. **A W Cash Valve Mfg Corp, Wabash & Morgan St, Decatur 60, Ill.**



Check Valve E14

OUTSTANDING FEATURE of the *Chexflo* valve is its flexible tubular operating member, comprised of a fixed load section, tapering down to a sensitive operating lip, which requires no differential pressure to effect positive bubble-tight shutoff. In open and closed positions, tubular member is fully supported against extreme pressure or intensive impulse shocks by inner walls of valve body and cylindrical acorn-shaped core which it encompasses. Device is suitable for handling air, gas, water and refined petroleum products at temperatures to 180 F. **Grove Regulator Co, 65th & Hollis St, Oakland, Calif.**

pH Meter E15

PHOTOVOLT ELECTRONIC PH METER is a line-operated instrument for laboratory and industrial applications for all types and designs of electrodes. Indicating meter is equipped with a 7-in. scale and mirror for convenient readings at high precision. Meter covers a complete pH range, no reversal switch being required. Instrument

To secure additional information on these new equipment items, use convenient reply cards on page 190A. Please be sure to identify your request with the new equipment key letter and number, as shown on the items above.

REVERE detects *VIBRATION* at a distance

DO you know that vibration can be present in the tubes of a condenser, though not perceptible in the shell? Putting the palm of your hand on a condenser is not a good test for destructive vibration. The best test is one carried out in the Revere Research Laboratory in Rome, N. Y., which makes a microscopic examination of the metal as a part of its work in determining causes of tube failure. If vibration contributed to short life, this examination will show it. Vibration accelerates corrosion in several ways. The alternating stresses in time produce cracks across the grain of the metal, weakening it and giving corrosive fluids more points to attack. Vibration also breaks or disrupts or disturbs the thin film on the surface of the metal that protects it and helps reduce the rate of corrosive attack. Of course vibration is but one of a number of factors influencing the service life of condenser tubes, and so when tube life is questioned we always suggest that samples from failed tubes be sent to us. We may be able to help you, as we have others, with suggestions that should materially extend the period between re-tubings.

REVERE

COPPER AND BRASS INCORPORATED

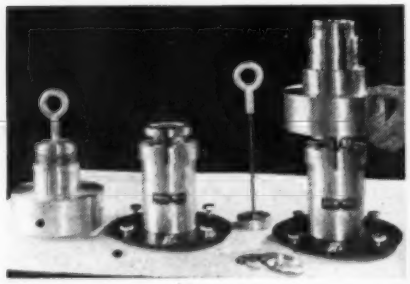
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

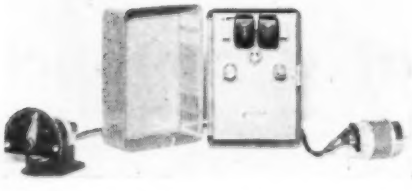
Equipment *Continued*

operates directly on any ac power line of frequency of 50 to 60 cycles. A voltage selector makes it usable on any voltage between 90 and 275 v. Standard glass electrode furnished with the instrument is fully shielded. It can be used attached to the pH meter or installed some distance away. Dial, in addition to the pH scale, is equipped with a millivolt scale from —400 to +400 millivolts. **Photovolt Corp, 95 Madison Ave, New York 16, N. Y.**



Pressure-Test Unit E16

PORTABLE DEADWEIGHT pressure-test unit is specifically designed for central stations. By using several units, accurate pressure data can be obtained for heat-balance calculations. Test unit is equipped with bull's-eye level and leveling screws. Internal piston is designed with mechanical stop to eliminate hazard of excess pressure forcing it out of cylinder. Each test unit is given a hydrostatic test of 10,000 psi. **Mansfield & Green, 1051 Power Ave, Cleveland 14, Ohio.**



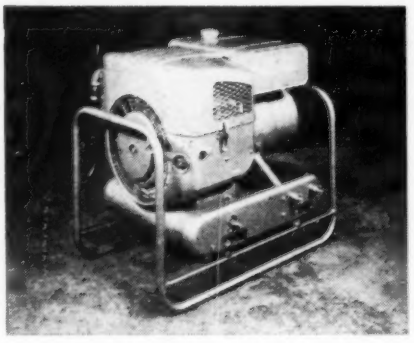
Positioning Control E17

ELECTRONIC POSITIONING control system is designed to (1) control inaccessible dampers accurately from control stations on the floor, (2) position heavy work in machine tools, and (3) open and close or adjust to intermediate position valves and gates from a single control station. The system has three parts (1) a master control station, (2) a follow-up device, and (3) an electronic control panel. The driving motor is not included in the system because any reversing ac or dc motor that handles the load is satisfactory. Operation consists of setting a dial similar to a radio dial; then the motor automatically moves the load to position corresponding to that of dial.

The system can be used on drives up to 1½ hp, and on many drives over this rating after considering inertia of load, speed, gear reduction and accuracy of position requirements. **General Electric Co, Schenectady 5, N. Y.**

Oil-Resistant Insulation E18

AN OIL-RESISTANT COMPOUND for splicing electrical wire is made of *Neoprene* rubber combined with special synthetics. It is for service on any electrical circuit coming in contact with oil. The material is distributed in form of tape 30 ft long, ¾ in. wide, and 0.030 in. thick. **United States Rubber Co, Rockefeller Center, New York.**

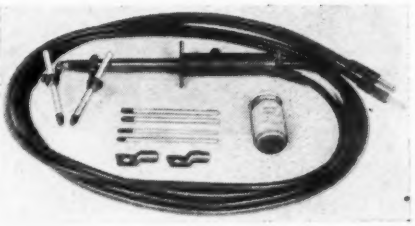


Arc Welder E19

SUREWELD is a portable gas-driven dc arc welder that two men can lift. Generator and engine are directly and solidly connected, forming a single, compact unit. Aluminum housing and aluminum alloy parts in the engine make the unit light in weight. Welder is rated at 150 amp at 30 v on 50% duty cycle. It has a 4-cycle 2-cylinder opposed-design engine. Electrodes up to and including 5/32 in. and certain types of 3/16-in. ones may be used with the welder. **National Cylinder Gas Co, 205 W Wacker Dr, Chicago, Ill.**

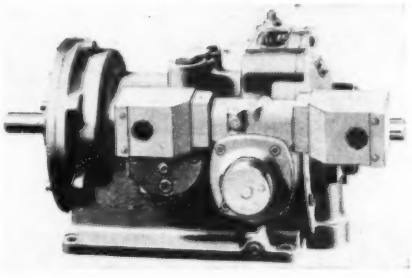
Magnetic Pulley E20

THIS COMPLETELY SELF-ENERGIZED magnetic pulley requires no electric current to generate a magnetic field. It is adaptable to all applications requiring automatic separation of magnetic from nonmagnetic materials conveyed on a belt. Preparation of metal-free coal at the mine is simplified by this new pulley. It can be installed deep in the mine, or on a portable conveyor, or high up in a tipple without need of electrical wiring. This Eriez self-cleaning unit is often installed outdoors for removing tramp iron from coal ahead of crushers and pulverizers. Neither intense heat, rain or sudden temperature changes affect its performance. Unit works effectively through belts of rubber, canvas, leather or any nonmagnetic material, thereby performing an automatic separation. Unit can serve in hazardous locations without danger of sparks. **Eriez Mfg Co, 2641 E 12th St, Erie, Pa.**



Arc Torch E21

DOUBLE-CARBON ARC TORCH is available for welding and brazing operations that require a soft flame. Current conducting members are two concentric metal tubes, one sliding within the other and insulated by fiber sleeve, thus automatically maintaining alignment for all adjustments of arc gap widths. Torch can be used with all types of arc-welding machines, ac or dc, and is furnished with both bayonet and lug type terminal connectors. It will accommodate carbon electrodes from ¼ to ⅜ in. dia. Arc gap can be held at constant length by a light pressure on control button. **C E Phillips & Co, 2750 Poplar St, Detroit 8, Mich.**



Fluid Power Transmissions E22

REVERSIBLLE VARIABLE-SPEED fluid transmission has a volumetric variable-delivery, radial rolling-piston pump, driving a constant displacement radial rolling-piston motor. High-grade oil, as the power fluid, flows through passages from unit to unit to provide automatic forced and flood lubrication. Compact case incloses operating mechanism. Relief valves in fluid passages protect unit against overload. Oil reservoir can be integral with machine or mounted on a separate base attached to transmission casing.

Control can be by: (1) hand screw for accurate setting of output-shaft speed from zero to maximum in either direction (2) hydraulic servomotor lever for rapid and

(*Continued on page* 164)

To secure additional information on these new equipment items, use convenient reply cards on page 190A. Please be sure to identify your request with the new equipment key letter and number, as shown on the items above.

A NEW NALCO SERVICE

for utilities and industrial plants

what the NALCO service agreement gives you:

- A complete plant water treatment survey; followed by a detailed report and recommendations on the best means of solving your specific water treatment problems.
- Supervision of water treatment control and testing practices to assure continued water treatment efficiency; and to minimize the possibility of shutdowns due to water treatment troubles.
- Regular Nalco Service calls to check results; and routine water analysis reports from the Nalco Laboratories to detect and correct changes in raw water characteristics.

UTILITIES and plants where the need for water treatment chemicals is small—due to low make-up, good raw water characteristics, or low water volume requirements—can now secure the full benefits of Nalco Water Treatment Service, regardless of chemical purchases.

This new Nalco Service is the answer to a growing demand for expert water treatment analysis and advice on control and testing procedures. Plants operating under a Nalco Service Agreement receive the full use of the complete Nalco facilities, experience and skill in setting up and maintaining a water treatment control system designed for the specific conditions under which each plant operates.

Brief facts on the Nalco Service Agreement are given at left. For further information, write Nalco, or call your Nalco Representative.

NATIONAL ALUMINATE CORPORATION

6222 W. 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

THE SCIENTIFIC SYSTEM OF WATER TREATMENT FOR ALL INDUSTRY

nalco

How to plan AUTOMATIC SPRINKLER SYSTEM TANK CONNECTIONS

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

AN **automatic sprinkler system** using two primary water supplies, gravity and pressure tanks is represented in this layout. It conforms with the code of the National Board of Fire Underwriters for the Installation of Sprinkler Equipment and Gravity and Pressure Tanks.

Tank discharge lines may be carried separately in dead risers down to the lowest point in the system and there connected to the sprinkler supply risers. In an installation where the low point is at least 40 feet below the bottom of the pressure tank, the tank discharges may be tied together to form the sprinkler supply line. This tie-in must be made a minimum of 40 feet below the bottom of the pressure tank to prevent air lock in lines after pressure tank is emptied. Air lock would prevent discharge of the gravity tank. Both tank discharges are fitted with Iron Body Checks and O.S.&Y. Gates.

The pressure tank must be installed in a room where a minimum temperature of 40° F. is maintained, both to meet code requirements and to prevent freeze-up. The gravity tank is usually located on the roof exposed to weather. This installation necessitates a heat exchanger to maintain the required 40° F. minimum tank water temperature.

In compliance with code requirements, all valves in steam and condensate lines are of the bronze globe type. The condensate trap is provided with a globe valve by-pass. All gate valves in lines 2″ and larger must have an Iron Body and be of the O.S.&Y. type to tell at all times the position of the wedge. Fig. 825, recommended throughout, is approved by both the National Board of Fire Underwriters and Associated Factory Mutual Fire Insurance Companies.

Other types and pressure ranges of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

Fig. 825, recommended throughout this layout is an Iron Body Gate Valve, with Outside Screw and Yoke, for 175 pounds water pressure. A rising spindle indicates extent to which valve is open or closed. It is fitted with a solid wedge having rolled-in bronze faces. Bronze metal is also used for seat rings, stuffing box bushing, stuffing box nuts and glands.

Jenkins PRACTICAL PIPING LAYOUTS 26

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

- **A** Use the right type valve for the service.
- **B** Place valves correctly in the line.
- **C** Choose Jenkins Valves for lifetime economy.

Fig. 825
IRON BODY GATE, O.S.&Y. Traveling Spindle

A CHOICE OF OVER 600 JENKINS VALVES

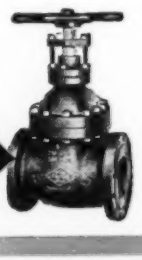
To save time, to simplify planning, to get all the advantage of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK



125 TO 600 LBS. STEAM PRESSURE

Jenkins Bros

AUTOMATIC SPRINKLER SYSTEM TANK CONNECTIONS

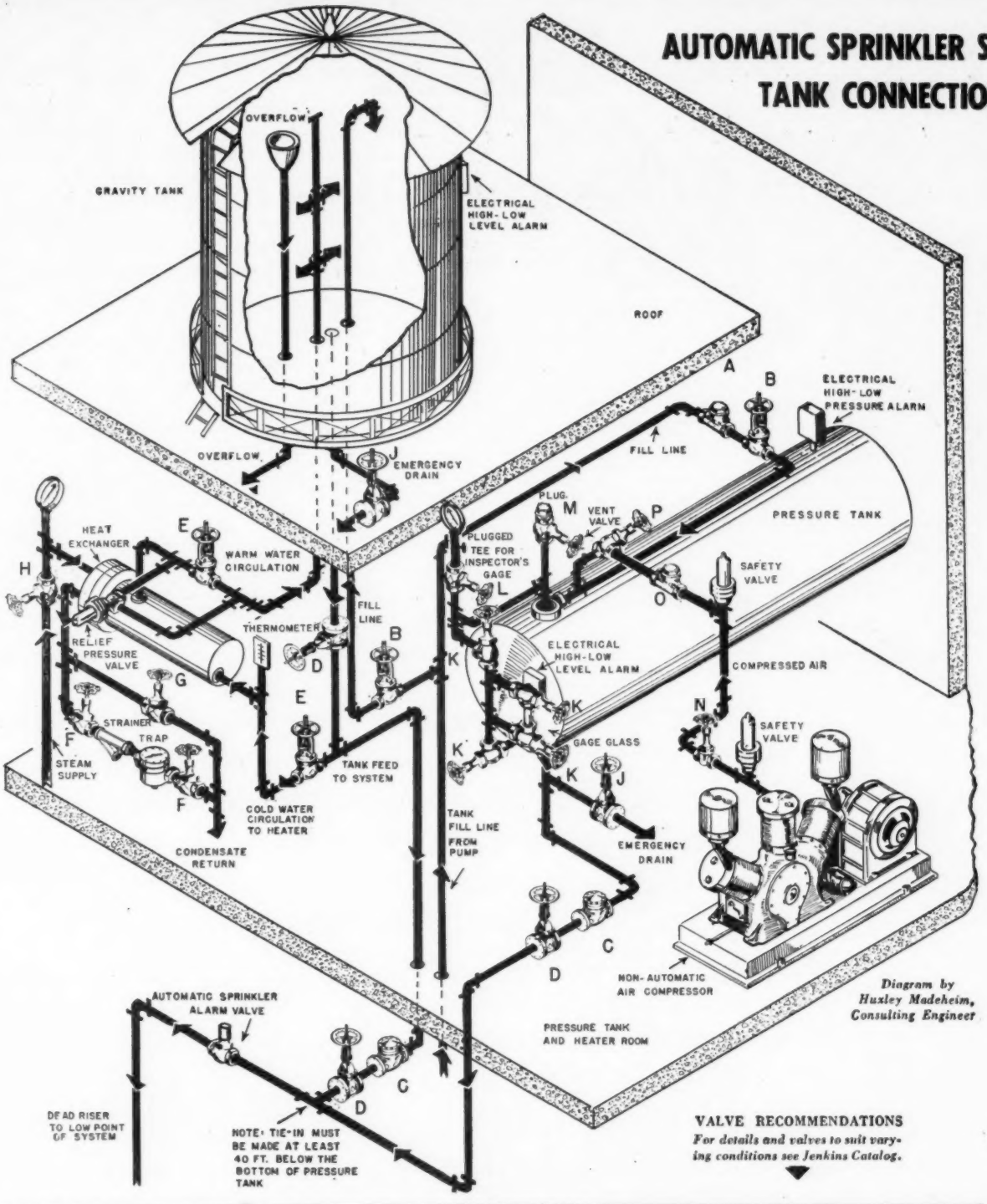


Diagram by Huxley Madeheim, Consulting Engineer

VALVE RECOMMENDATIONS

For details and valves to suit varying conditions see Jenkins Catalog.

Code	Quan.	Jenkins Valve	Service
A	1	Fig. 352 Bronze Swing Check	Tank fill line
B	2	Fig. 275-U Bronze Gate	Tank fill line
C	2	Fig. 629 I.B. Swing Check	Tank discharge to sprinkler system
D	3	Fig. 825 I.B. O.S.&Y. Gate	Tank discharge to sprinkler system
E	2	Fig. 275-U Bronze Gate	Water circulation to heater
F	2	Fig. 106-A Bronze Globe	Condensate trap shutoff
G	1	Fig. 106-A Bronze Globe	Condensate trap by-pass

Code	Quan.	Jenkins Valve	Service
H	1	Fig. 106-A Bronze Globe	Steam admission to heater
J	2	Fig. 825 I.B. O.S.&Y. Gate	Emergency Tank Drain
K	4	Fig. 108-A Bronze Angle	Gage glass & pressure test
L	1	Fig. 106-A Bronze Globe	Pressure Gage Control
M	1	Fig. 106-A Bronze Globe	Air Vent Control
N	1	Fig. 47 Bronze Gate	Air Compressor Shutoff
O	1	Fig. 352 Bronze Swing Check	Prevent backflow to compressor
P	1	Fig. 108-A Bronze Angle	Compressed air shut-off

BRONZE • IRON • STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS BROS., 80 White St., New York 13, N. Y.

Please send me a reprint of Piping Layout No. 26.

Name .....

Company .....

Address .....

.....

Number 181

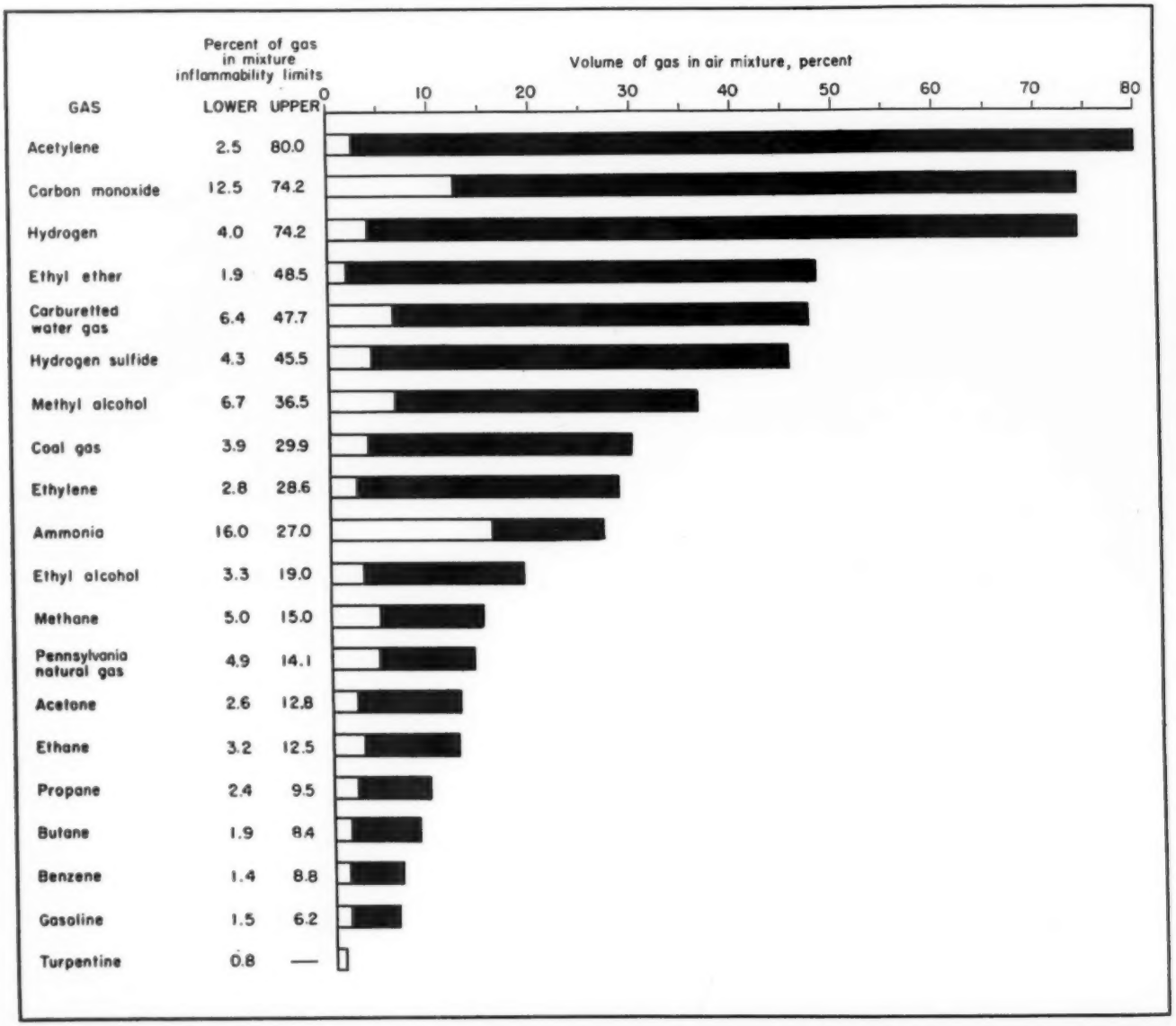
Gas-Inflammability Limits in Air

▶ AN INFLAMMABLE MIXTURE of gases, such as methane and air, may be diluted with one of the constituents until it is no longer inflammable. The dilution limit of inflammability is the borderline composition: A slight change in one direction supports burning; in the other direction combustion cannot be maintained.

There are two well-defined limits within which self-propagation of flame will take place after ignition. These are "upper" and "lower" limits defined in terms of percentage volume of gas present in mixture of gas and air. The combination chart and table lists these limits for some of the common gases and vapors in air at atmospheric temperature and pressure.

Within these limits the gas-air mixture liberates enough energy to continue propagation of flame from one layer to the next. Mixtures above the upper limit may burn on contact with external air, since these are formed in the zone where gases mix. Certain conditions effect a shift in the limits, either increasing or decreasing the spread between them. These include: ignition source, direction of flame propagation, containing-vessel dimensions, humidity, oxygen content, pressure, temperature and turbulence. Reference: G W Jones, *Chemical Review*, Volume 22, 1938, pp 1-26.

By J Constance



© POWER

Read the Reports on Performance!

Sometimes it's easier to promise results than to produce them. But COPES Flowmatic Feed Water Control has a happy habit of making good on every promise. Close stabilization of the boiler water level means greater safety. Feed input geared to steam output means greater efficiency. Day-by-day dependability with only routine attention and care means greater surety of correct boiler operation.

These facts stand out in the reports received week after week from the steadily-growing list of users. An authorized performance report describes in detail each installation pictured on this page. Write for the one most closely related to your own operating conditions. You'll profit from reading the interesting data presented.

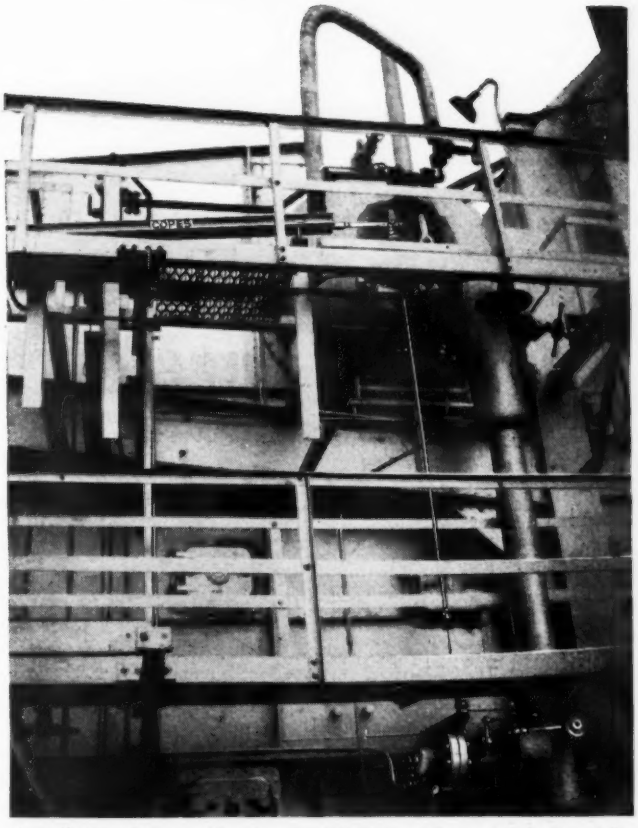
NORTHERN EQUIPMENT COMPANY

971 GROVE DRIVE, ERIE, PENNSYLVANIA

Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

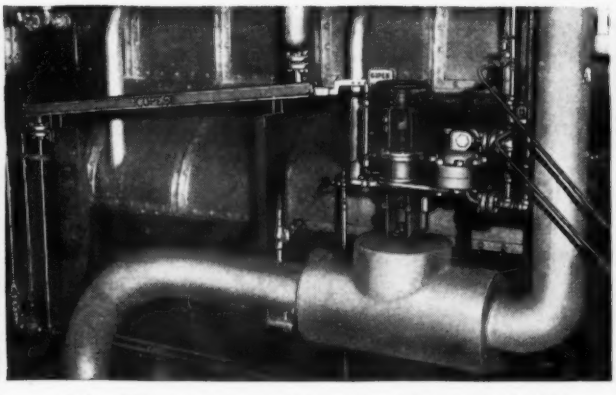
BRANCH PLANTS: Canada, England, France, Austria

Representatives Everywhere

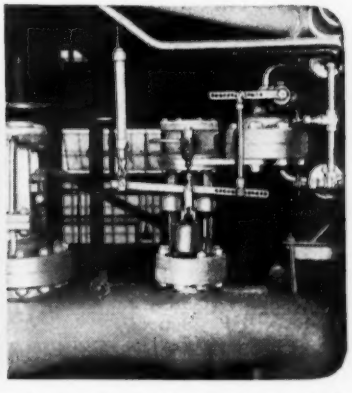


Installed outdoors, direct-operated Flowmatic controls level for 450-psi, 160,000-lb-per-hr Riley boiler carrying fluctuating power and process loads. Bulletin 413 tells the interesting story.

Direct-operated Flowmatics control water level on forge plant 120-psi B & W boilers. See Bulletin 459

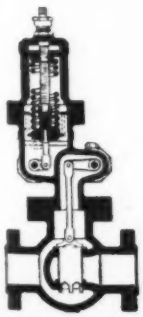


Relay Flowmatic controls level for 875-psi, 450,000 lb-per-hr C-E unit. Three plants in this utility system are discussed in illustrated 16-page Bulletin 469



Relay-operated Flowmatic control: 675-psi Erie City unit in Eastern utility plant. See Bulletin 445

★ *Get Closer Level Control With The* COPES **FLOWMATIC**

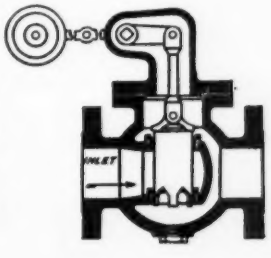


PUMP GOVERNORS

In most installations, especially where the load conditions do not warrant COPES Flowmatic control, good feed water regulation should begin at the boiler feed pumps. *Dependable* excess water pressure control for your feed system, no matter how simple or how demanding your needs, can be provided by COPES engineers. Write —outlining your operating conditions in detail—for their helpful recommendations.

BALANCED CONTROL VALVES

Many plants have found real savings by paying a few dollars more for COPES Balanced Valves for controlling make-up water to feed water heaters, level in open tanks, evaporator flows and other uses. Control is more accurate with the scientifically-balanced, practically-frictionless COPES. Rugged construction assures long service life.



No Time to Rest On Your Laurels

I'VE BEEN SAYING for a good many years that the power engineer's job is about as important a proposition as you can find anywhere in the country. Now comes the very complete report "America's Needs and Resources"—prepared by the Twentieth Century Fund, a privately endowed research organization—which defines this importance in strong terms.

"The key to our future economic welfare," says the report, "is productivity. It is the five-fold increase in output per man-hour that has made it possible for us to work shorter hours and still enjoy a rising standard of living. This increase in productivity has been accomplished, not by working harder, but by constantly inventing better machinery to *supplement human energy with mechanical power.*" (The italics are mine.)

In other words, if we are going to cut down the work week from 44 hours to 40, to 38, and still lower to 35, we've got to back up each worker with more power to take up the slack. And if we are to improve our living conditions with better housing, faster transportation, more life-guarding medicines, and so on—we have to provide more steam, more electricity, more mechanical energy and other power services to produce these gains. All of which makes the power engineer a key man in our economy.

When you get down to close analysis, you'll find that every change or improvement—whether political, social, economic or engineering—requires more power to make the forward step possible. Sounds like a pretty broad statement, I'll agree, but just try to find any loopholes in it.

And don't think you're going to have time to rest on your laurels tomorrow, next year, or even next decade. According to the Twentieth Century Fund, there will be tremendous expansion during the next few years in the amount of energy produced and in the benefits gained through increasing use of the various forms of power. Here are the figures:

Year	Total energy output, billions hp hrs	Horsepower per worker	Goods per worker per hr, 1944 prices	Length of work week, hours
1880.....	39.9	1.3	$.36	65
1890.....	61.1	1.6	.48	63
1900.....	82.9	2.2	.59	61
1910.....	131.4	2.8	.65	57
1920.....	197.4	3.3	.71	52
1930.....	238.3	4.9	.97	48
1940.....	289.4	6.5	1.22	43
1950*.....	410.4	7.4	1.44	41
1960*.....	489.8	8.2	1.70	38

* Estimates by Twentieth Century Fund

There's the prediction—and it's certainly not one that will lessen the role of the power engineer in the American way of life. Rather, it calls for continued study and improvement of power equipment and methods, even more efficient ways of generating, transmitting and applying the power services. It looks like a very full, busy fifteen years ahead for all of us.

George Edwards

Engineer

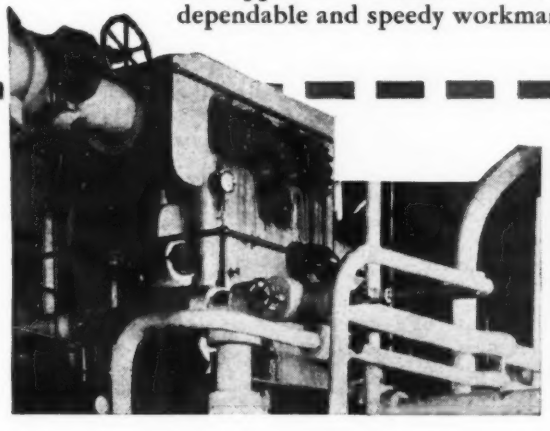
24 Years of Service
IN RAILROAD POWER PLANT

Another example proving...: the right insulation correctly applied, never grows old.

ENGINEERING: The first step in an insulation job that will give years of service, such as the Railroad installation described below, is to call in an experienced insulation engineer. Johns-Manville maintains a staff of insulation experts. Each man knows how to take the guesswork out of your job...make it *"right* the *first* time."

RIGHT INSULATION: Many types of insulations are necessary to meet varied service conditions. In the Johns-Manville Research Laboratory—largest of its kind in the world—new and more efficient insulations have been developed. J-M Insulation Specialists help you choose the *right* insulation for each temperature requirement—from minus 400° up to 2800° F.

CORRECT APPLICATION: No insulation is better than the man who installs it. J-M Insulation Application Units are industry's first choice for completely efficient jobs because (1) Each Unit is trained in all phases of insulation application; (2) Only skilled mechanics and up-to-date application methods are used. You get thorough, dependable and speedy workmanship.



24 YEARS YOUNG! Johns-Manville Insulations were installed in this power plant of the Missouri, Kansas, Texas Rail Road Company at Parsons, Kansas, back in 1923. Because this job was *engineered right* and *applied right,* it is still providing dependable insulation service. For help on your insulation problems, write Johns-Manville, Box 290, New York 16, N. Y.

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POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

AEC Reports on Problems of Atomic Energy Program

▶ THE ATOMIC ENERGY COMMISSION, feeling that industry has a "stand off" attitude toward atomic work, stated its worry in its second semiannual report to Congress: "If this country is to maintain its preeminence in the atomic field, many well-managed industries and other private undertakings now otherwise engaged must actively participate . . . even if this requires that for a time they set aside what they are now doing."

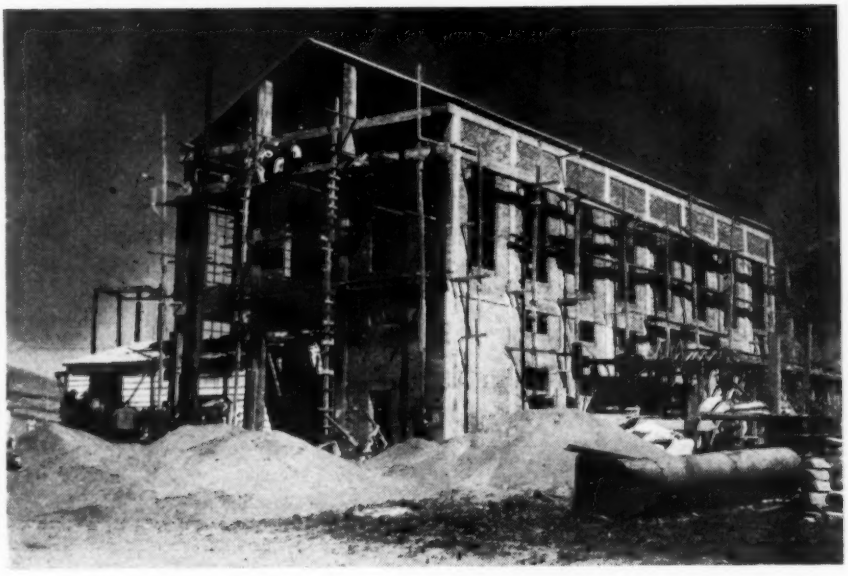
Relations between the commission and its contractors are thus recognized as one of AEC's major concerns. This is particularly the case because of the policy of handling nearly all operating functions through contractors.

The AEC has a number of advisory committees studying various aspects of the problem—a committee on contractor relations; a committee on accounting, which is trying to develop—to replace the rather sketchy Manhattan District system—something that will be adapted to needs of both the government and various industrial and university contractors; a committee on patents that hopes to recommend definite policies soon for carrying out the somewhat ambiguous requirements of the atomic energy act.

Beyond this, the commission reports little concrete action except that it is lengthening the term of some of its contracts beyond the one-year agreements previously used. It has executed a 4-year contract with Carbide & Carbon Chemicals Corp. This covers operation of the gaseous diffusion plant at Oak Ridge as well as the electromagnetic separation plant there, which Carbide & Carbon took over from Tennessee-Eastman Corp last May. In addition, a number of new research contracts now incorporate a 3-year guarantee of salaries for key scientists.

The AEC report reveals that production of atomic weapons is now the main preoccupation of the commission. A proving ground for tests of such weapons is being established "in the Pacific."

(*Continued on page* 180)



Home for Western Hemisphere's First Commercial Gas-Turbine Power Unit

When visited by World News correspondent Russ Anderson, the building was under construction at Chimbote, Peru, and the turbine had been delivered but not yet erected. This unit, designed for emergency service, is rated at 4000 kw though it is capable of delivering 5000 kw with a larger generator. On the test bed in Baden, Switzerland (see POWER, April 1947, pp 68-69) this unit operated at 19.5% over-all efficiency with an inlet gas temperature of 1020 F. Because of the nature of service required of the unit, it has few components: turbine, compressor, generator and starting motor—all on a single shaft. No regeneration, intercooling or reheating is included in the cycle

COMING EVENTS

Sept 2-9—Fuel Economy Conference, The Hague, Netherlands. H C Forbes, treasurer and secretary, Executive Committee of U. S. National Committee, World Power Conference, 4 Irving Pl, New York 3, N. Y.

Sept 8-12—Instrument Society of America, second annual instrument conference and exhibit, Stevens Hotel, Chicago, Ill. Richard Rimbach, executive secretary, 1117 Wolfendale St, Pittsburgh 12, Pa.

Sept 23-25—American Institute of Electrical Engineers, Middle Eastern district meeting, Biltmore Hotel, Dayton, Ohio. H H Henline, 33 W 39th St, New York 18, N. Y.

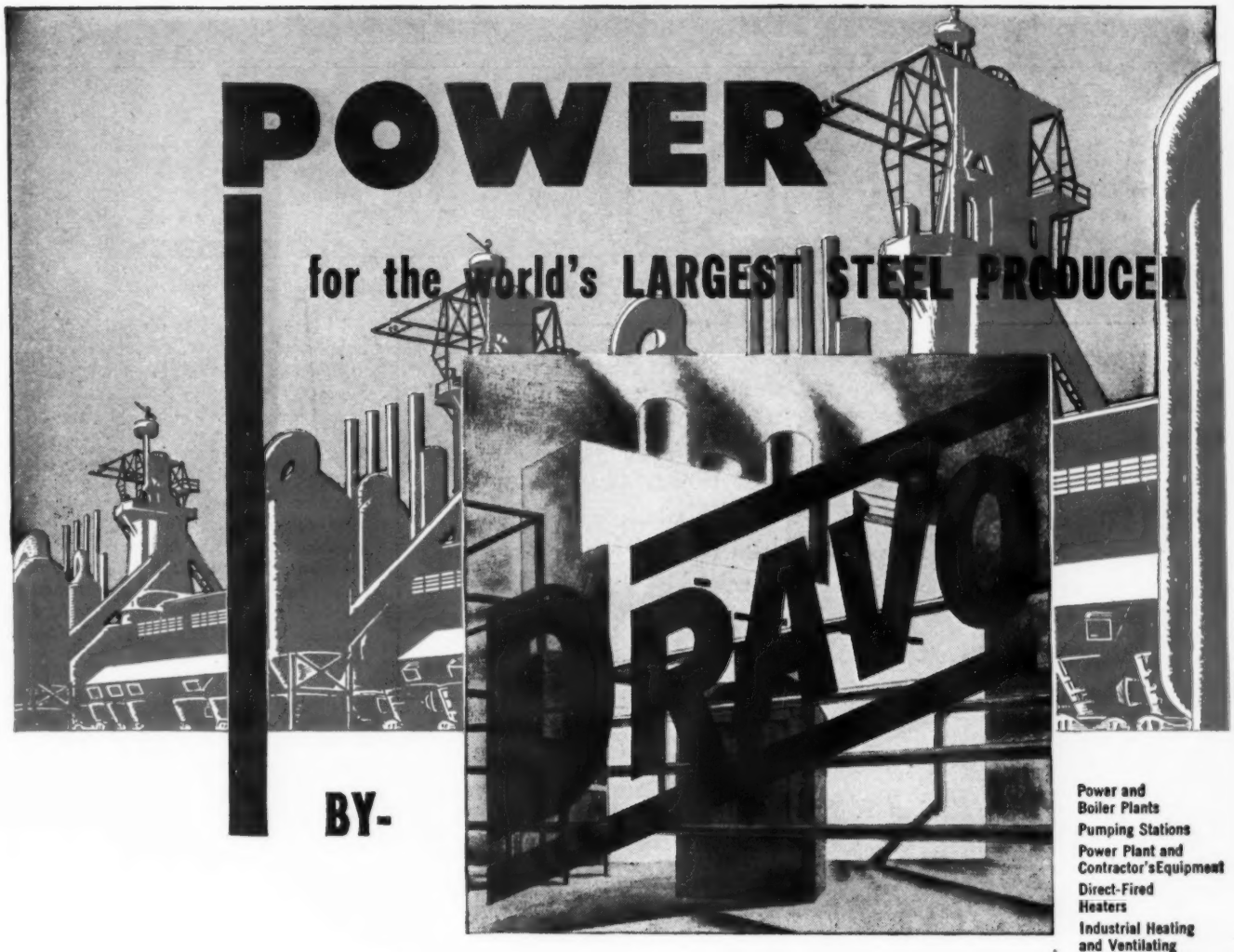
Oct 16-17—National Conference on Industrial Hydraulics, third annual meeting, Hotel Continental, Chicago. Dr V L Streeter, Armour Research Foundation, Technology Center, Chicago 16, Ill.

Oct. 19-24—American Welding Society, annual meeting, Sherman Hotel, Chicago, Ill. M M Kelly, secretary, 33 W 39th St, New York 18, N. Y.

Oct. 20-22—American Society of Mechanical Engineers, fuels div meeting, Hotel Gibson, Cincinnati, Ohio. O B Schier, 29 W 39th St, New York 18.

Nov 3-7—American Institute of Electrical Engineers, Midwest meeting, Congress Hotel, Chicago, Ill. H H Henline, 33 W 39th St, New York 18, N. Y.

Nov. 12-14—Engineers' Society of Western Pennsylvania, 8th annual water conference, William Penn Hotel, Pittsburgh, Pa. H M Olson, general chairman, Ohio Salt Co, Isabella St, Pittsburgh, Pa.



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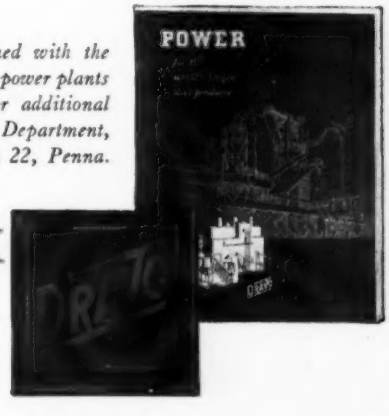
TYPICAL example of the results which you, as a purchaser and operator of power plants, can expect from the application of the DRAVO *Single-Contract Method* of Power Plant Construction is this installation for the Edgar Thomson Works of Carnegie-Illinois Steel Corporation.

☆ The need was urgent, the construction complicated. To relieve its own engineering staff of additional burdens of supervising and coordinating many sub-contracts, Carnegie-Illinois Steel Corporation, acting through Defense Plant Corporation, and the Consulting Engineers decided to place major responsibility with a single contractor.

☆ With more than a half century of experience in the construction of boiler and power plants and the installation of equipment, DRAVO was prepared to accept this responsibility. Under the DRAVO *Single-Contract Method* a definite price and a definite schedule for construction were assured. The reliance on DRAVO experience and responsibility produced tangible results when the construction schedule was maintained to completion and major equipment was put into service approximately six months before the completion date.

Industrialists and Engineers concerned with the construction and operation of boiler and power plants will want to read Bulletin AU-513 for additional details of the success of this project. Power Department, DRAVO CORPORATION, Pittsburgh 22, Penna.



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BOOKS REVIEWED IN THIS ISSUE

HEATING AND AIR CONDITIONING • CHEMISTRY FOR OUR TIMES
METHODS OF CHEMICAL ANALYSIS OF METALS • RADIANT HEATING
VARNISHED CLOTH FOR ELECTRICAL INSULATION
FUNDAMENTALS OF NAVAL WARFARE • MECHANICAL VIBRATIONS
FINANCIAL ADMINISTRATION OF MUNICIPAL UTILITIES
ELEMENTARY FLUID MECHANICS
GENERATORS AND MOTORS AND THEIR APPLICATIONS
NATIONAL ELECTRICAL CODE HANDBOOK • SIX-PLACE TABLES
MEN AND VOLTS AT WAR • FUELS, COMBUSTION AND FURNACES
SIXTY YEARS WITH MEN AND MACHINES • HEAT PUMPS

Generator and Motor Applications

GENERATORS AND MOTORS AND THEIR APPLICATIONS (1947). *By D J Duffin.* 210 *pp*, 7½x10, *illust, cloth.* $4. *McGraw-Hill Book Co,* 330 *W 42nd St, New York* 18.

First of a group of three, this comprehensive working manual is written for motor repairmen and other electricians. It makes the reader familiar with the great variety of types and makes of motors and generators. It is easy to read and understand, yet the subject is completely covered.

To emphasize simplicity, electrical theory is kept to a minimum. Outstanding among the many photographs and drawings are a variety of disassembled views, which show the reader how equipment is constructed.

Fuels and Combustion

FUELS, COMBUSTION, AND FURNACES (1946). *By John Griswold, prof of chemical engrg, University of Texas.* 496 *pp*, 6x9 *in., illust, cloth.* $5.50. *McGraw-Hill Book Co,* 330 *W 42nd St, New York* 18, *N. Y.*

Intended primarily as a text in chemical engineering, this book brings together an essentially complete fundamental background and survey of current developments in both theory and practice. Readers with a good basic knowledge of chemistry, mathematics and physics will find it a valuable source of information on the many recent developments in the art and science of fuel technology and combustion.

Particular attention is given to a thorough presentation of the properties of the various fuels, the material on petroleum and natural gas being especially good. The mechanism and chemistry of the combustion process are extensively treated, and the modern concepts of combustion reactions clearly presented. Material on fuel-burning equipment and furnace practice is necessarily condensed because of space limitations in a general text, but the basic principles are thoroughly explained.

The engineer desirous of acquainting himself with the many new concepts of combustion processes will find this book worth careful study.

Reversed Refrigeration

HEAT PUMPS (1947). *By Philip Sporn, E R Ambrose, Theodore Baumeister, respectively, president, air-conditioning engineer and consulting engineer of American Gas and Electric Service Corp.* 188 *pp*, 5½x8½, 111 *illust, tables, cloth.* $3.75. *John Wiley & Sons, Inc,* 440 *4th Ave, New York* 16.

Here's a technical treatment of the many problems in adapting the heat pump to heating and cooling services. Discussion covers thermodynamic principles; design, specification and selection of equipment; operating, economic and installation problems. No attempt is made to analyze the theory, performance and design of the apparatus that must be assembled to complete a heat-pump installation. The authors have written this book in the hope of stimulating greater interest and activity in heat-pump development.

Handbook on Electrical Code

NATIONAL ELECTRICAL CODE HANDBOOK (1947). *By Arthur L Abbott.* 633 *pp*, 4¾x7¼, *cloth.* $4. *McGraw-Hill Book Co,* 330 *W 42nd St, New York* 18, *N. Y.*

This book serves as an easy reference in grasping the contents of the *National Electrical Code.* Its first consideration is to make the meaning and intent of the Code entirely clear.

There are six parts, which bring out the fundamental divisions of the Code. Many photos and drawings bring out points in the text. The subject index and a cross index with the Code are well prepared.

Heating, Air Conditioning

HEATING AND AIR CONDITIONING *(revised 1946) 6th edition. By John R Allen, late past president ASH&VE; James H Walker, vice-president. The Detroit Edison Co; John W James, research engineer, Iron Fireman Mfg Co, 667 pp, 6x9, 330 illust, cloth, $5.50. McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y.*

This textbook for engineering schools and individual study makes the subject clear to a student who is unfamiliar with it.

New section on panel heating is included. Also, the principle of reversed-cycle refrigeration system is considered theoretically and practically. Odor-removal apparatus and air sterilization are discussed.

All material on gravity warm-air furnace heating and residence air conditioning has been revised to include the latest rating formulas and design procedures. Other developments in heating, ventilation and air conditioning are adequately covered.

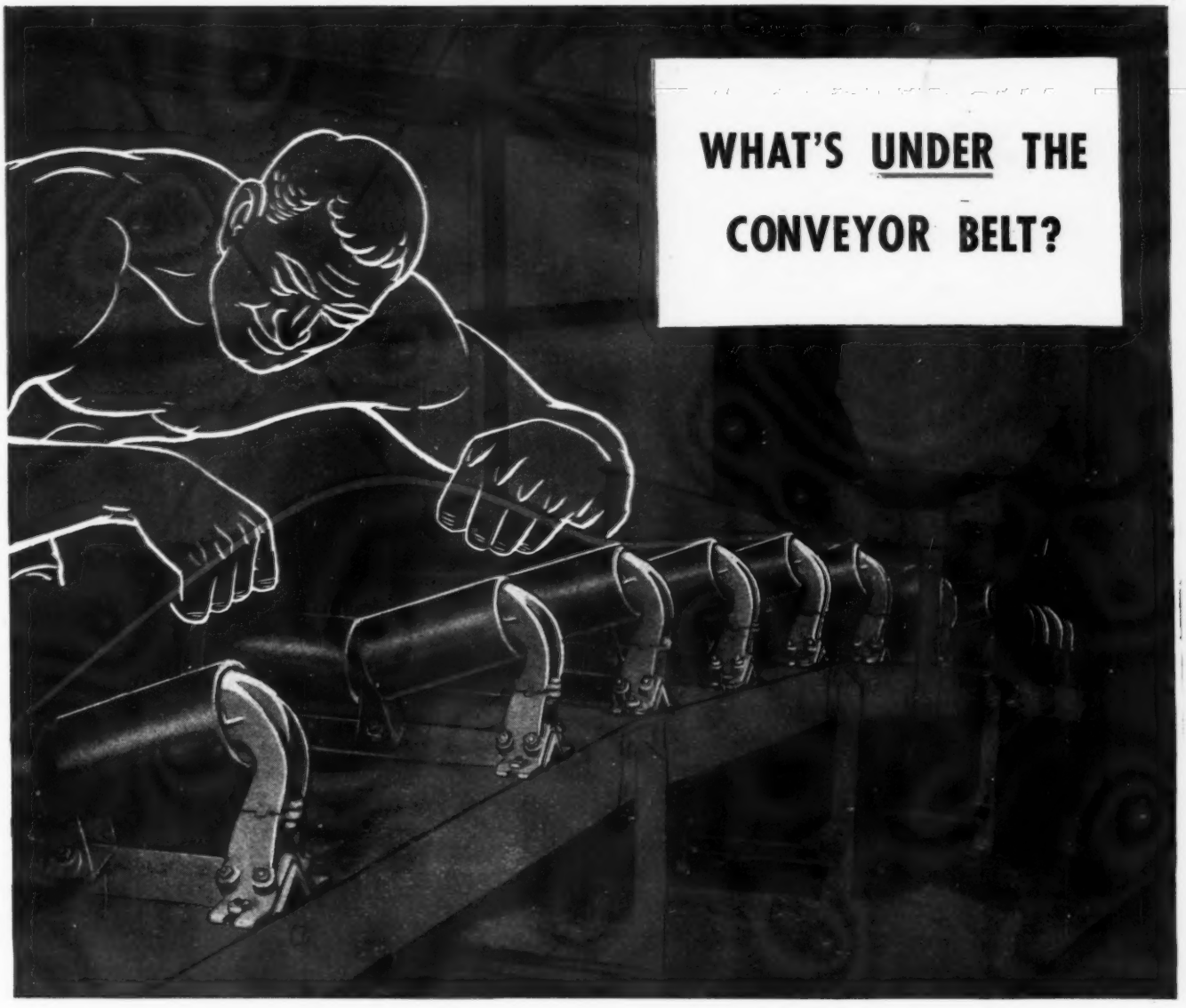
Electrical Insulation

VARNISHED CLOTH FOR ELECTRICAL INSULATION *(1947). By H W Chatfield, chief varnish research chemist, Jenson & Nicholson, Ltd, and J H Wredden, process-development chemist, Igranic Electric Co, England. 233 pp, 5½x8½, 62 illust, 51 tables, cloth. $6. Chemical Pub Co, 26 Court St, Brooklyn 2, N. Y.*

Varnished insulating fabrics can be classed as the most important materials in practically every kind of electrical equipment. If insulation fails, a machine goes out of business, often with disastrous effects. In spite of this, insulation materials have not had the attention their importance warrants. This book helps to correct the situation.

The authors have collected information that was scattered through technical and trade literature, adding data from their own researches and experience. They tell the textile manufacturer something about the processes his fabric undergoes to produce varnished-cloth insulation, and the properties desired in the finished product. Likewise, the varnish maker is told something about the textiles on which his varnishes are applied, and how they contribute to the

(*Continued on page* 146)



The carriers are the measure of the conveyor's efficiency

Belt conveyor carrying ore from pit to surface loading pocket at Oliver Iron Mine. Belts ride on S-A SACON carriers.

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- **Bearings enclosed in dust and moisture-tight self-aligning housings, with labyrinth grease seals.**
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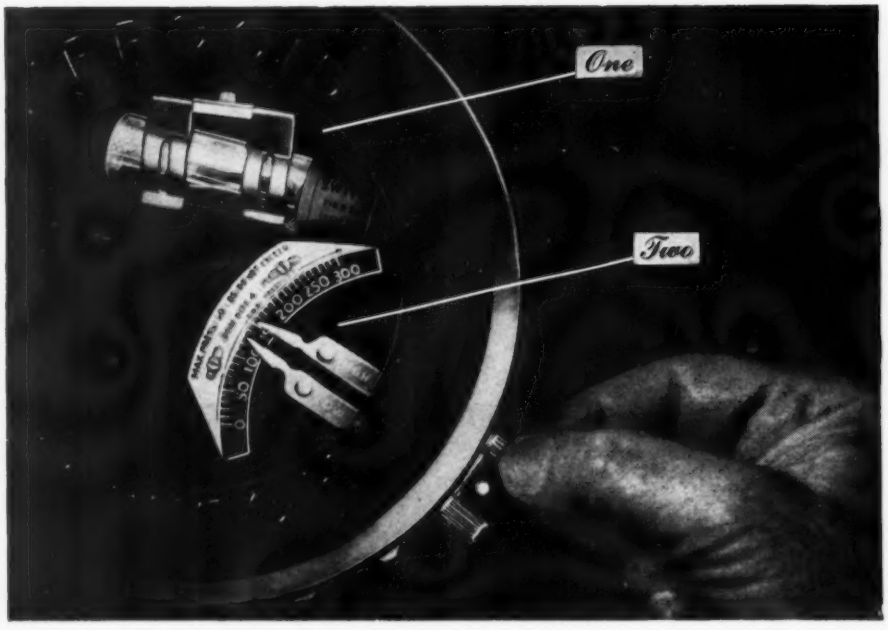

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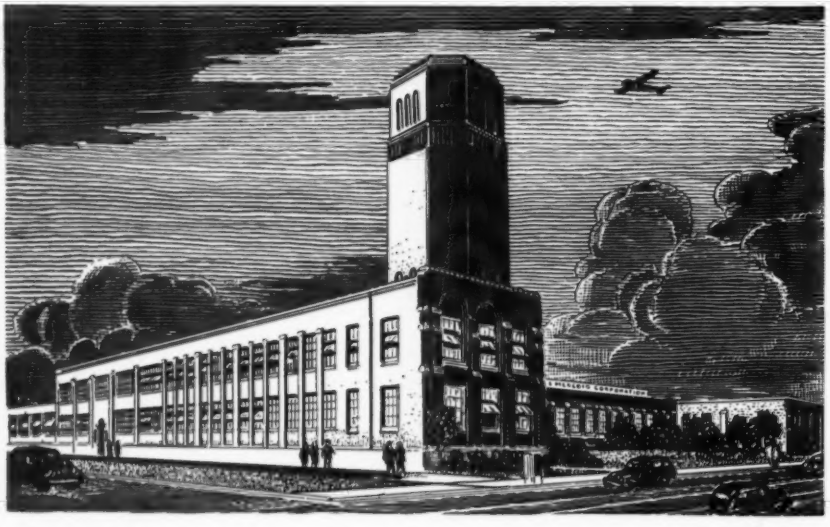

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Engineer's Bookshelf

(*Continued from page* 144)

production of a flexible electrical insulation. Finally, the electrical engineer and other electrical workers are told what qualities to expect in varnished-cloth insulation. Everyone interested in electrical insulation will find here a wealth of information on fabrics and varnishes as applied to electrical equipment.

Naval Science

FUNDAMENTALS OF NAVAL WARFARE (1947). *By Lee J Levert.* 488 *pp*, 5½x8½, *illust, cloth.* $5. *The Macmillan Co.* 60 *5th Ave, New York, N. Y.*

The Navy always has a strong appeal for engineers because of its utilization of the science of engineering. This book, while written for the layman, will interest technical men since its comprehensive scope shows the organization of the Navy as a whole. Its readable style offers a quick way to learn how warfare was carried on in the recent world conflict and how it compared with previous wars. In discussing individual functions, the book covers: weapons, ships, shore installations, types of naval warfare, engineering, communications, staff organization.

Machine Design

MECHANICAL VIBRATIONS. *Third edition* (1947). *By J P Den Hartog, professor of mechanical engineering, Mass. Institute of Technology.* 478 *pp*, 6x9¼, 282 *illust, cloth.* $6. *McGraw-Hill Book Co,* 330 *West* 42*nd St, New York* 18, *N. Y.*

This book is as simple in style as can be compatible with the subject of mechanical vibrations. In treating all cases, the simplest mathematical approach available has been used. Items covered: kinematics of vibration, single degree-of-freedom system, two degrees of freedom, many degrees of freedom, multicylinder engines, rotating machinery, self-excited vibrations, systems with variable or nonlinear characteristics. This edition includes additional topics on airplane wing flutter, helicopter ground vibration, torsional pendulum dampers, singing ships' propellers and electronic instruments.

Chemical Analysis of Metals

METHODS OF CHEMICAL ANALYSIS OF METALS. *412 pp, 6x9, cloth, $4.50. Pub by the American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.*

The 1946 book, replacing the 1943 edition, gives the latest form of 35 extensive standards developed by ASTM committees concerned with analyzing metals and their alloys. The greatly expanded volume includes modernized versions of methods widely used throughout industry, as well as several of the newer photometric methods. It also provides spectrochemical methods of analysis for certain materials and elements.

There are recommended practices cover-

This special "Y" combines two 10-inch, standard weight, long radius welding elbows—TUBE-TURN Part No. 1, immediately available everywhere.
15" R
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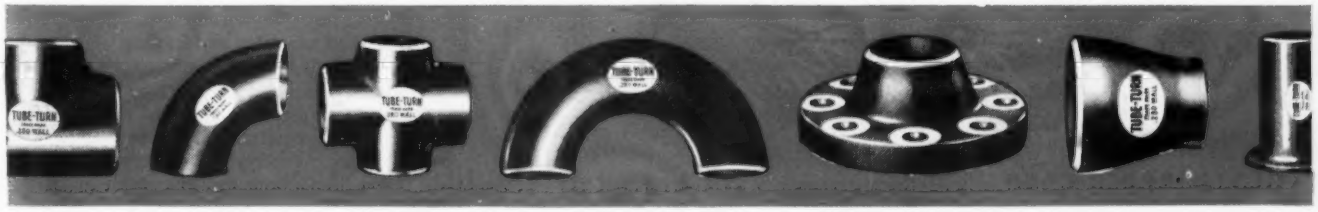

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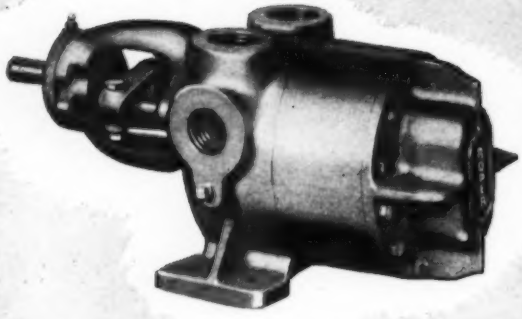

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ing apparatus, reagents and photometric methods. The extensive methods of sampling and chemical analysis of steel, cast iron, wrought iron, etc, are included, with methods of sampling and analyzing ferro alloys. A considerable portion of the new volume is devoted to nonferrous metals, including sampling, chemical analysis and photometric methods covering aluminum, magnesium, copper, lead, lead and tin-base alloys, solders, zinc and nickel. Of the 35 standards, seven pertain to photometric methods, and five involve spectrochemical procedures. Sixteen of the 35 methods carry 1946 designations, indicating that they are either new or revised.

These methods are for general use in buying and selling materials according to specifications. They are planned to provide such precision and accuracy that when used by competent chemists they are satisfactory for judging the adherence of materials to specifications.

Basic Chemistry

CHEMISTRY FOR OUR TIMES. *By Elbert C Weaver, instructor, Phillips Academy, and Laurence S Foster, formerly asst professor of chemistry, Brown University, chief, Powder Metallurgy Branch, Research Div, Laboratory Dept of the Watertown Arsenal. 738 pp, 6x9, numerous illust, cloth, $2.48. McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y.*

This basic first book for chemistry students stresses scientific principles and the effect of chemistry on everyday life. Discussed are pertinent topics like vocational opportunities, as well as the latest developments in chemistry, including the atomic bomb and recent research in industrial chemistry.

Although written for high-school students, the book will be a welcome addition to the library of a power engineer, who needs to know the basic fundamentals of chemistry.

Radiant Heating

RADIANT HEATING. *By T Napier Adlam, vice-president Sarco Mfg Co, 472 pp, 6x9, illust, imitation leather, $6. The Industrial Press, 148 Lafayette St, New York 13, N. Y.*

Although popularity of radiant (or panel) heating of buildings has been growing rapidly for years, references to the subject have been almost entirely in isolated technical papers, articles, or relatively brief publications of pipe and tubing manufacturers. The subject has grown to a point where a really comprehensive treatise is needed.

Practical in its approach, the book thoroughly covers design, installation, and control of hot water, steam, warm air, and electric radiant-heating systems for buildings. In addition, the related, but relatively new, subjects of snow melting and radiant cooling are discussed in detail.

Intended for engineers, contractors, architects and builders, the book is primarily a working manual. Included are 64 full-page charts for determining pipe size and spacing for many types of floor and ceiling construction. Data resulting from the author's

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Pipe fittings are so hard to get, so hard to replace, that it makes sense to save as many as possible on every installation. When you use Super-Silvertop Steam Traps, you save up to nine fittings per trap over the ordinary inverted bucket trap design. But that's not all. The saving in installation time (as much as 60 minutes per trap) is not to be "sneezed at" these days. Besides, Super-Silvertop gives you these savings throughout the size and pressure range —in the big No. 24 and 25 traps and steel traps as well as in the smaller and lower pressure ranges.

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Super-Silvertop showing one nipple and one union needed.

Conventional trap using seven fittings and two unions.

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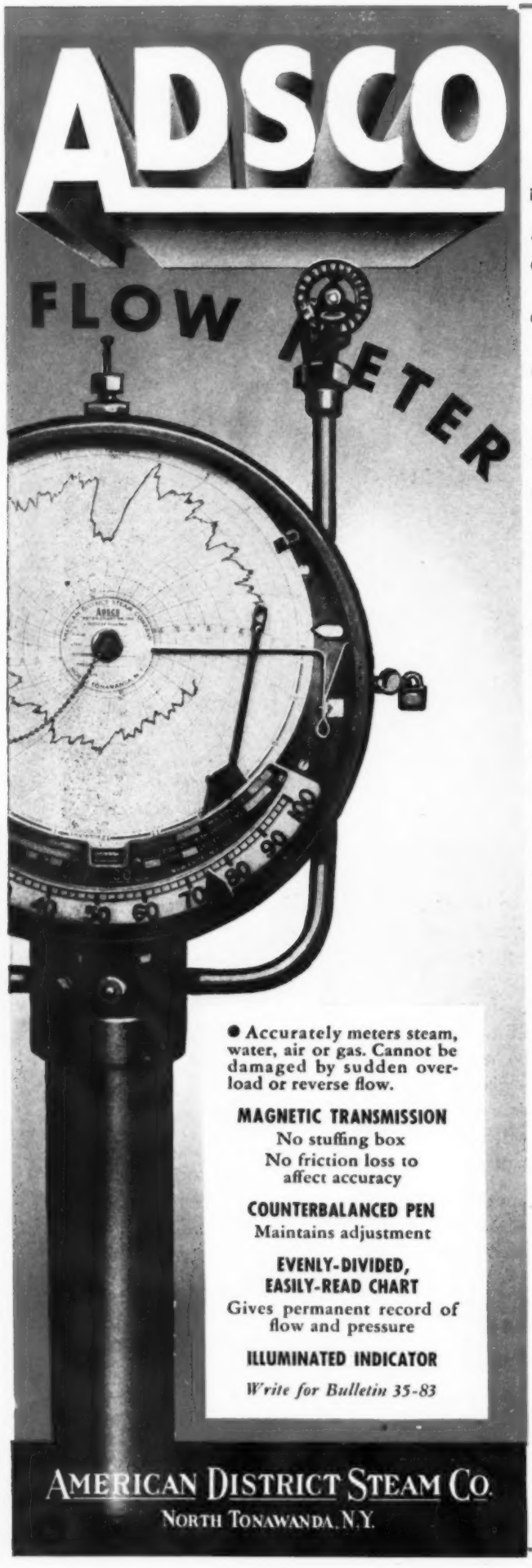

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No stuffing box
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own tests on effect of floor coverings are also included. Formulas have been reduced to the simplest terms to meet practical requirements; easy-to-use charts give most of the essential design data without calculation. Exact step-by-step procedure in designing and installing radiant-heating systems is summarized.

Machine Tools

SIXTY YEARS WITH MEN AND MACHINES. *By Fred H Colvin in collaboration with D F Duffin.* 297 *pp*, 6x9, *illust, cloth.* $3.50. *Whittlesey House,* 330 *W* 42*nd St, New York* 18, *N. Y.*

This story of the rise and development of the machine tool industry is really two stories. Fred Colvin, editor of *American Machinist* from 1907 to 1937, parallels his growth in life with the growth of the machine tool industry during 60 years. Both engineers and laymen will enjoy the book's chatty, "back-of-the-mill" style, and any reader who has ever cranked and cursed a stubborn engine will experience nostalgia in the discussion of the early days of the auto industry. Engineers will take particular interest in the history of the ASME. Among the hilarious reminiscences is the attempt to convince an old-timer of the necessity for standardizing gages in mills.

Machines have often been blamed for unemployment yet the amazing progress of the U. S. would have been impossible without them. They have produced a better economy and a higher standard of living for those who developed them; without them, progress has been at a snail's pace, as in China and India. There is much truth in Mr Colvin's clever paraphrase of John Donne's famous line: "No machine is an island, complete in itself; every tool is a piece of the continent, a part of the main, and therefore never send to know for whom the drill turns; it turns for thee."

Mathematical Tables

SIX-PLACE TABLES *Seventh edition* (1947). *By Edward S Allen, professor of mathematics, Iowa State College.* 232 *pp*, 4½x7, 14 *tables, leatherette.* $2.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

A truly handy pocketbook of mathematical tables used by engineers and designers. Included is a marginal index with which any table can be speedily found without referring to page numbers. Tables include squares, cubes, roots, circumference, areas, reciprocals, fifth powers, circles, common logarithms, logs of trig functions, natural trig functions, radians and degrees, functions of radians, factorial logs, natural logs, trig formulas, integrals and constants.

War Saga of Electricity

MEN AND VOLTS AT WAR *(1947). By John Anderson Miller. 272 pp, 6x9, illust, cloth. $3.75. Whittlesey House, McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y.*

Primarily, this is the story of the General Electric Co in World War II, but in a broader sense it tells of the men and women who stayed at home. Although they could

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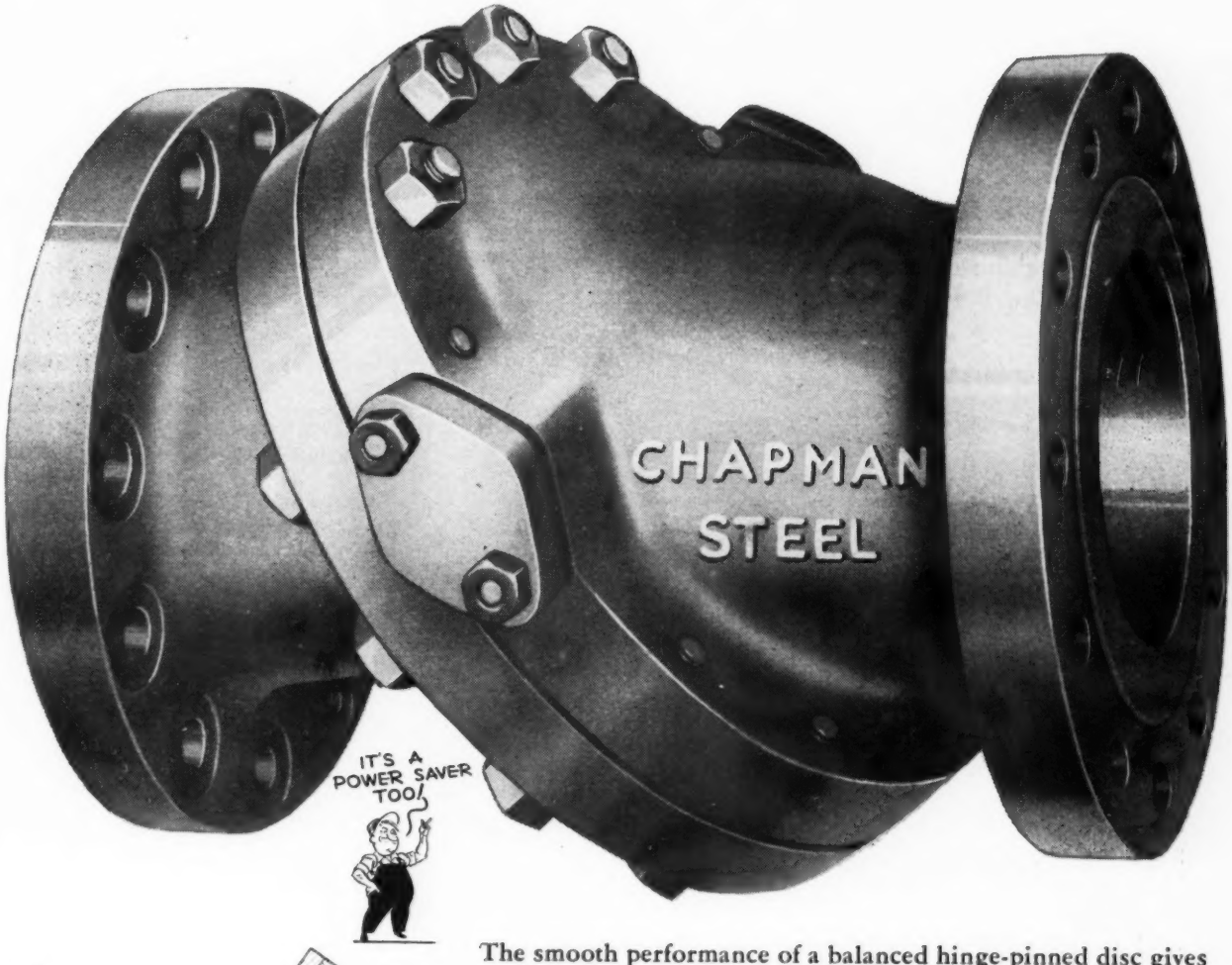

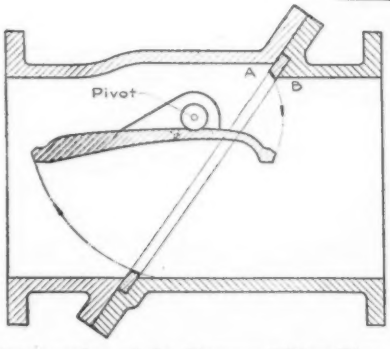

Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

The smooth performance of a balanced hinge-pinned disc gives Chapman Tilting Disc Check Valves a quiet, "cushioned closing." There's no slamming, as in ordinary check valves, and therefore no destructive pipe-line stresses. This means that water hammer and its resultant vibrations and strains in pipe lines are eliminated.

This unique check valve not only reduces maintenance costs but effects savings of from 65% to 80% in head losses over conventional type check valves. And Chapman Check Valves are available in either iron or steel.

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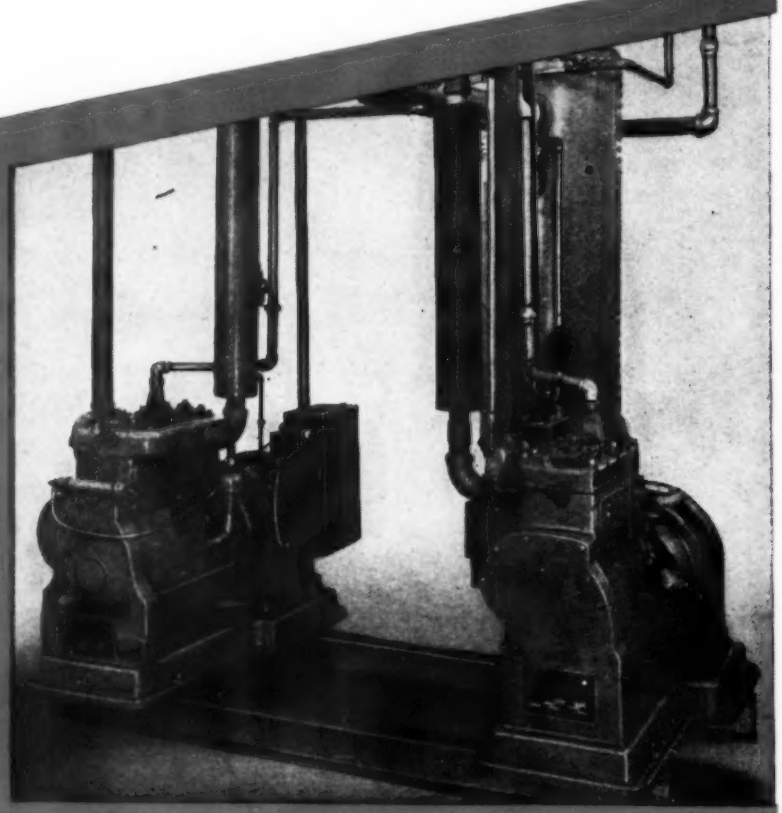

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not win the war, they could—through failure to do their part—help to lose it. How they met that challenge, as it never was met before, is the saga of "Men and Volts at War."

Because of the almost countless kinds of power, electrical and other equipment produced by GE, the story may also be considered that of the production war fought by large and small plants from coast to coast. Upon some industries and companies, however, there fell an exceptionally heavy responsibility: They alone had the experience, skill, resourcefulness and facilities to make certain essential equipment and make it quickly in large quantities, as was true of GE.

The book, however, is not just a history of the battle of production, exciting as that may be. How this material and equipment were used to win the war is an even more astounding tale.

Utility Accounting

FINANCIAL ADMINISTRATION OF MUNICIPAL UTILITIES (1947). *By Irving Tenner, CPA.* 152 *pp*, 6x9¼, 25 *illust, cloth.* $3.75. *Public Administration Service,* 1313 *East 60th St, Chicago, Ill.*

For engineers who have an extracurricular interest in the business aspects of utilities, here is a quick introduction to the problems usually dealt with by management. While these financial principles can be adapted to any type of utility, this book specifically treats of electric and water plants. Subjects cover: financial organization and policies; rate structures; budgeting; debt administration; customer accounts; custody and control of cash; purchasing, storing and issuing of supplies; fixed assets; accounting principles and procedures; financial reporting.

Fluid Mechanics

ELEMENTARY FLUID MECHANICS *Second edition* (1947). *By John K Vennard, associate professor of fluid mechanics, Stanford University.* 339 *pp*, 5½x8½, 198 *illust, tables, cloth.* $4. *John Wiley & Sons, Inc,* 440 *4th Ave, New York* 16, *N. Y.*

This introduction to the field of fluid phenomena is written primarily for the engineering student. By sacrificing detail and rigor of mathematical treatment in favor of presenting the basic physical idea, the book gives special recognition to the fact that most students have had very little experience with fluids.

Static and dynamic conditions of fluids are covered as indicated by chapter headings: fluid statics, flow of ideal compressible and incompressible fluids, impulse-momentum principle, flow of real fluids, similarity and dimensional analysis, flow in pipes and open channels, measurements, flow about immersed objects.

BOOKLETS

BIBLIOGRAPHY OF BUREAU OF MINES INVESTIGATIONS OF COAL AND ITS PRODUCTS, 1940 TO 1945 *By A C Fieldner, chief of fuels and explosives branch, Bureau of Mines, P L Fisher, former coal technologist, and Mar-*

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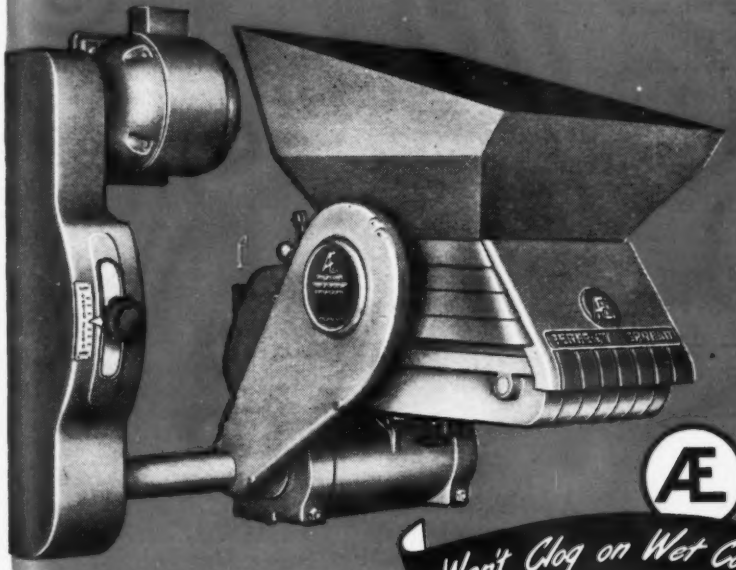

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jorie B Pollock, research assistant, fuels and explosives branch. Send 15c *for copy to Superintendent of Documents, U. S. Government Printing Office, Washington* 25, *D. C.* Investigations on coal and its products have been described in detail in previous publications issued by the Government Printing Office or Bureau of Mines and in articles by staff members published in periodicals, books and journals distributed by the technical press. *Technical Paper* 698 classifies these publications into 19 divisions.

A Selected List of Bureau of Mines Publications Dealing With the Chemistry and Refining of Petroleum and Oil Shale *Available on request to Bureau of Mines, Dept of Interior, Washington* 25, *D. C.* More than 250 Bureau of Mines publications and special articles on chemistry and refining of petroleum and oil shale are enumerated in a selected list of publications. Included are titles of previously published reports on Bureau petroleum and oil-shale research during the past 35 years. In addition to pioneer Bureau research, the selected list contains titles of reports based on cooperative work with State of Oklahoma at Petroleum Experiment Station at Bartlesville, Okla., and with University of Wyoming at Petroleum and Oil-Shale Experiment Station at Laramie, Wyo.

Directory of Member Institutions and Review of Current Research (1947) *By John I Mattill, secretary, Engineering College Research Council.* 103 *pp,* 9x6 *in., paper,* $1. *Engineering College Research Council Office, State University of Iowa, Iowa City, Iowa.* Directory lists active research members, their research staff, policies, expenditures and projects. Booklet also gives associate members, Engineering College Research Council officers and committees, official representatives of member institutions, past officers and bylaws.

American Safety Standards 20 *pp, illust,* $10\frac{3}{4}$x$7\frac{3}{4}$ *in. Available on request to American Standards Association,* 70 *E* 45*th St, New York* 17, *N. Y. Catalog PM*87 contains a list of about 200 standards covering safety and industrial health. This booklet also gives a brief description of contents of each standard, which makes it easier for those interested to locate standards concerning their own particular field.

Symposium on Atmospheric Weathering of Corrosion-Resistant Steels 92 *pp,* 9x6 *in., heavy paper cover,* $1.50. *American Society for Testing Materials,* 1916 *Race St, Philadelphia* 3, *Pa.* This symposium, presented at the 1946 annual meeting, is intended to give in convenient form an up-to-date picture, based on the latest data, of behavior of so-called stainless steels when exposed to atmosphere.

Arkansas Power & Light Co plans to increase the generating capacity of its newly dedicated Cecil Lynch power plant, east of North Little Rock, at a cost of $6,500,000, according to President C Hamilton Moses. Present capacity is 30,000 kw, which is to be increased to 90,000 kw. Original cost of the plant was $3,500,000.

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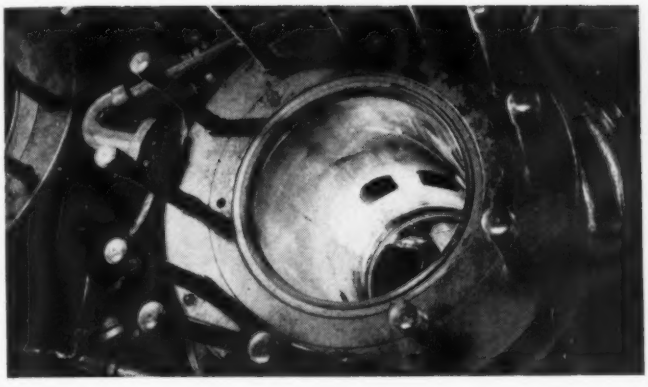
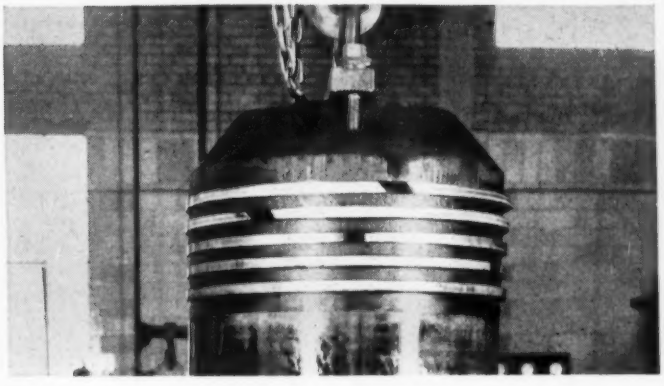
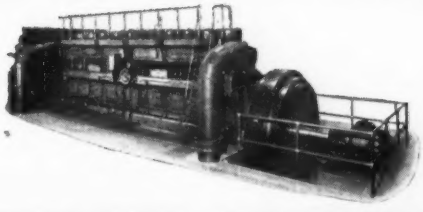
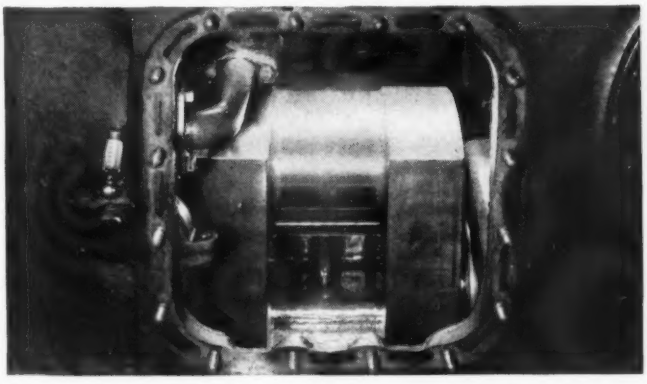


No piston or cylinder varnish. Troublesome varnish deposits that cause ring sticking are completely eliminated with Nonpareil HD. An inhibitor in Nonpareil HD reduces oil oxidation—the principal cause of varnish formation

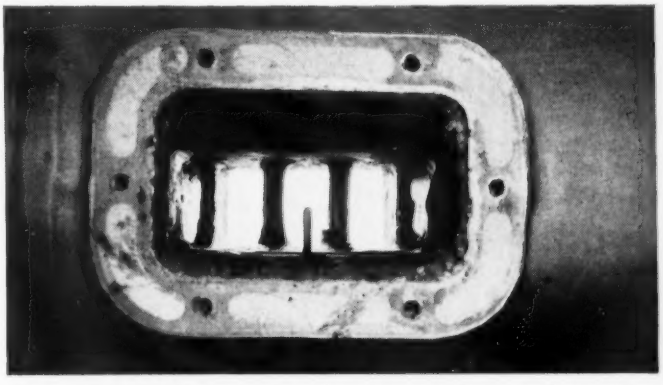


Low ring and liner wear. Nonpareil HD resists heat. The oil film on cylinder walls is not burned away at each firing stroke. A strong film of oil is always present between rings and liners to prevent wear.





Clean crankcases. Sludge does not form in crankcases with Nonpareil HD. Oil contaminants are held in suspension by a detergent additive until they are removed by the filter.



Less port carbon. Exhaust port carbon is materially reduced with Nonpareil HD, even when low grade fuels are used.

Complete freedom from troublesome deposits—the result of unusual oxidation stability *plus* detergency in Nonpareil HD Diesel Oil—means less wear, maintenance, and down-time on *any type* of industrial Diesel. Make a test of Nonpareil HD in one of your engines. A Standard Oil Lubrication Engineer will be glad to help you. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to contact the Engineer nearest you.

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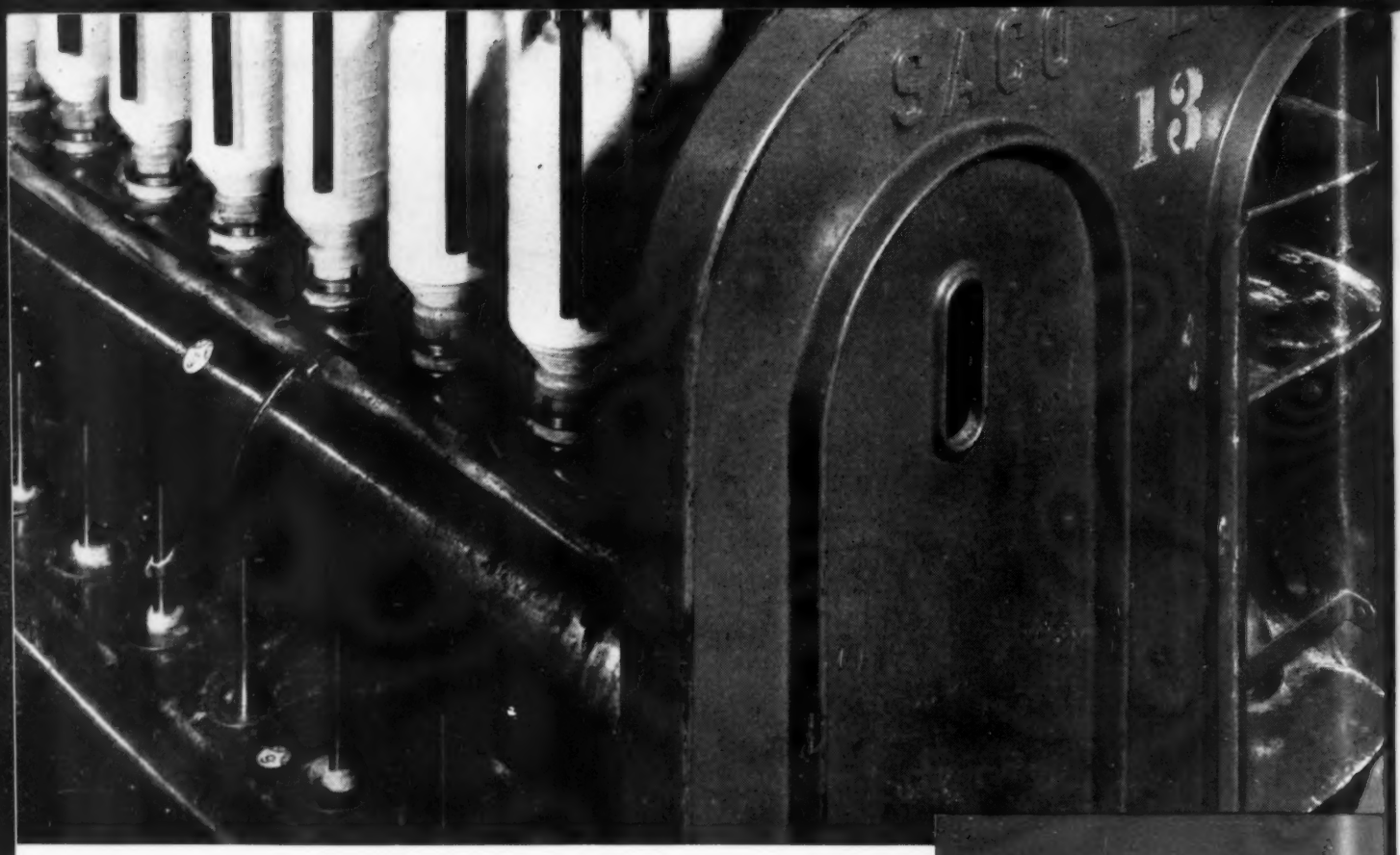

Textile Mill Gets 4-Way saving with . . . STANODRIP

1. **Oil consumption reduced 30%**
2. **Cost of labor to apply lubricant reduced 75%**
3. **Bearing replacements eliminated during year's operation**
4. **Product spoilage caused by oil dripping eliminated**

A change to Stanodrip solved four costly problems in a Midwest textile mill. With engine oil on the plain sleeve bearings—located on roving frames shown above—oil dripped onto the cotton threads. Also, it was necessary to apply this oil every four hours. Even then, bearings had to be replaced frequently.

With the change to Stanodrip, oil drippage disappeared and the period of time between oiling was gradually extended. Today the bearings are lubricated once every 16 hours—instead of every four hours. This has resulted in a 30% saving of oil and a 75% saving in the cost of labor for oiling. During the first year's operation with Stanodrip, not one bearing has failed.

For added protection against bearing trouble, Standard Coded Lubrication Service was installed throughout the plant. This insures application of the right product to the right places at all times.

Help on any lubrication problem is available through Standard Oil Lubrication Engineers. If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

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There's true economy in using long-lasting Darts because they can be set to work over and over again in many successive installations. With the two spherical-ground bronze seats forming true bearing surfaces, they close drop-tight without excessive wrenching, jamming, or damage, and open just as readily when needed for use in another location. Body and nut, made of high-test, air-refined malleable iron, are practically indestructible.

You'll find that it pays to standardize on Darts.

E. M. DART MFG. CO.
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Feedwater in Germany

(*Continued from page* 76)

Cooling Towers. Most of the large power plants use recirculated cooling water for surface condensers because water supplies are limited in the coal-deposit areas where most of them are installed. Thus, large cooling towers are common sights.

They are practically all of natural-draft type. The so-called counter flow units produce a temperature drop of about 16 F, and the cross- and counter-flow units, a temperature drop of about 25 F. Most of them are of wood, with a few exceptions like the venturi-shaped concrete units at the Espenhain-Molbis plant in the Leipzig, Saxony area, Fig. 8.

It was general practice in large plants to design each cooling tower with enough capacity to take care of one large turbine condenser. A minimum of 60 lb of cooling water per lb of steam condensed was used as a de sign figure. In practice, cooling capacity of most of the operating plants amounted to 60 to 80 lb of cooling water per lb of turbine condensate.

Chemical treatment of the cooling water was common. It ranged from the use of a few ppm of glassy sodium phosphate, to prevent calcium-carbonate condenser scale, to complete water softening through base-exchange units. It was also common practice for plants in high-bicarbonate-water districts to feed hydrochloric acid to the cooling-towers, to lower the carbonate hardness of the recirculated water.

German engineers have given wide distribution of data and operating experiences through their publications, technical meetings, etc. Dr A Splittgerber published tabulated data and curves showing pH concentration relationships of a number of chemicals commonly encountered by water-conditioning engineers and chemists, Table II and Fig. 9.

Rectifiers

(*Continued from page* 88)

welded to a flange on the tank to insure a vacuum-tight joint.

Fig. 4 shows a 500-kw 250-v dc load-center substation in an industrial plant. The ac switchgear and rectifier transformer are inclosed within the left-

SERIES 100 ATMOSPHERIC
Bulletin No. 100-46

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FOR EVERY REQUIREMENT OF

Power • Petroleum • Refrigeration
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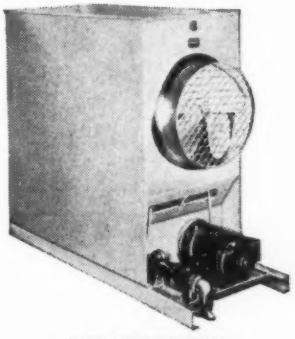

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With complete confidence in meeting any specified need, engineers the country over think of "MARLEY" when water cooling is the subject at hand. They know there is a MARLEY tower specifically fitted for every capacity and every operating condition.

Every MARLEY unit is the product of 25 years specialization in water cooling. All are thoroughly tested at the MARLEY research plant. All are backed by the MARLEY guarantee and the excellent service delivered by thousands of MARLEY Towers now in daily operation.

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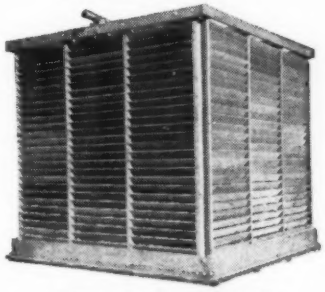

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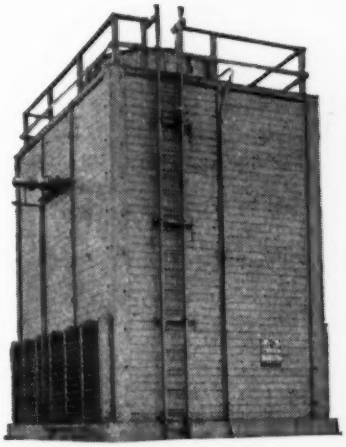

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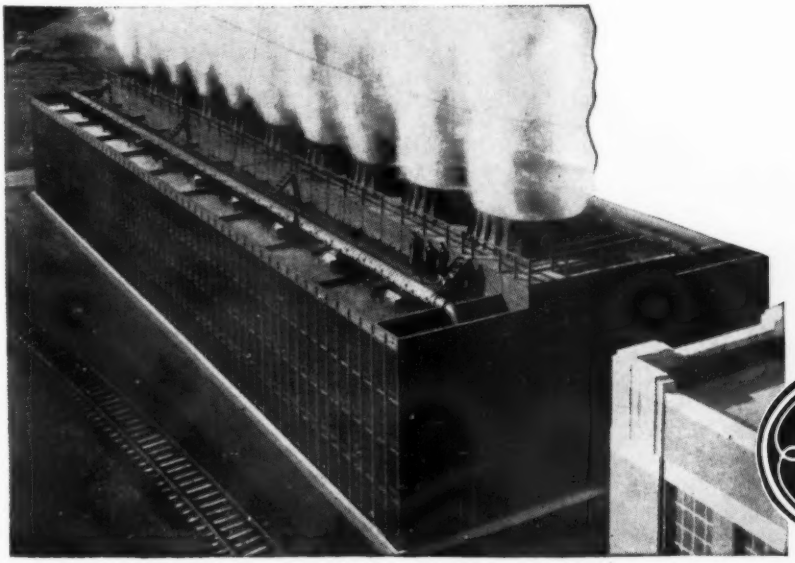

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Stickle Drainage and Control Equipment assures production unit performance of a high order. It provides required operating temperature, constant within close limits. In final results, this equipment makes possible such quality attributes as color, consistency, texture, flavor, or strength—necessary according to the nature and requirements of the finished product.

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With Stickle Drainage and Control, production flow is steady at, or near, production unit's potential capacity. The needs for effective operation and efficient production are provided. Stickle Drainage keeps units free of condensate which insures the highest possible efficiency. Stickle Control instantly reacts to temperature needs. Stickle Drainage and Control Equipment, for a single production unit, or for several, is prepared to obtain maximum results under specific conditions of operation.

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Stickle Regulating and Reducing Valves. Designed for industries requiring accurate control within extremely close limits of variation. Two series, in several types, meet all application and capacity requirements.

Stickle Open Float Steam Traps. Simple construction, positive action, large capacities, trouble-free. Series designs for all operating pressures in required sizes. Specify use and operating pressure.

Stickle Differential Drainage and Boiler Return System. A closed pumping system. Saves fuel and increases boiler capacity in like ratio. Improves quality of steam, reduces boiler scale, and lowers maintenance cost on valves, traps, and steam lines by eliminating high velocities.

Stickle Open Coil Feed Water Heaters and Purifiers. Preheat raw makeup water with exhaust steam which becomes one-sixth of boiler feed supply. Capacities 3,000-lbs. to 250,000-lbs. Deaerating or Non-deaerating.

STICKLE STEAM SPECIALTIES COMPANY

SPECIALIZING FOR MORE THAN 40 YEARS IN REDUCING THE COST OF STEAM

2265 Valley Avenue, INDIANAPOLIS 18, INDIANA

For more Efficient Results from Processing Units used in Food, Paper, Textile and other Industries Operating at High, Medium and Low Pressure and on Vacuum

hand sections. One of the two rectifier compartments has the doors opened to show six of the twelve tubes. The ignition-excitation and phase-control voltage-regulating equipment are assembled in the compartment to the right of the tube sections and the main dc breaker, and several dc power distribution breakers are located in the remaining sections.

These factory-assembled unit substations provide an economical, quiet, and efficient means of obtaining dc power in many industrial and electrochemical plants, and electric-traction systems. Portable dc rectifier substations of low head construction are available so they can be moved in a mine close to the load centers where dc power is required.

Pump Q and A

(*Continued from page* 124)

A—These pumps are built in two general horizontal units: (1) With two outside bearings and two stuffing boxes, Fig. 8. (2) A pedestal mounted and overhung pump with two outside bearings and one stuffing box, Fig. 9. Some manufacturers build these pumps mounted on a motor bracket, Fig. 10, similar to a close-coupled centrifugal pump.

Q 15—How do you compensate for wear in the clearances?

A—Clearances can be renewed by replacing the side plates or heads, or by changing gasket thicknesses.

Q 16—How much suction lift can these pumps operate against?

A—About 22 to 24 ft at their maximum capacity, but this figure can be increased as their capacity is decreased. Since these pumps can handle vapor as well as liquid they can be used on higher-suction lifts provided they have sufficient capacity to handle both the required volume of liquid and the vapor released because of the low-suction pressure. When pumping hot water or vaporizing liquids a 10- to 12-ft head on suction should be provided at maximum capacity.

Q 17—What are the common troubles and cures?

A—The commonest trouble is wear in the close running clearances. This can be cured by renewing these clearances as previously stated. Sticking of the impeller because of corrosion-erosion or foreign materials in the

This New Bulletin tells all about Ring Balance Meters ... a product of HAGAN CORPORATION

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How to bring those distant suppliers closer to home

It's like having all your suppliers close at hand, when you specify Air Express delivery. Air Express gets you what's wanted in mere hours . . . no matter *where* your suppliers are located.

Planes carrying your Air Express shipments are bigger and faster today. Even overnight coast-to-coast deliveries are routine. Same day delivery between many airport towns and cities. And Air Express rates are *low*. Use this speedy, profitable service regularly to keep customers satisfied, and business running without a hitch.

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Just phone your local Air Express Division, Railway Express Agency; for fast shipping action . . . Write today for Schedule of Domestic and International Rates. Address Air Express, 230 Park Ave., New York 17. Or ask for it at any Airline or Railway Express Office. Air Express Division, Railway Express Agency, representing the Airlines of the U.S.

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GETS THERE FIRST

Fastest delivery—at low rates

Trailer parts (51 lbs.) needed in Los Angeles *fast*. Picked up at Portland, Ore., factory 5 PM on 13th, delivered first thing next AM 821 miles away—*in time!* Air Express charge $12.52! Other weights, any distance equally inexpensive and *fast!*

1927— 20TH YEAR OF GETTING THERE FIRST! —1947

liquid is another common cause of trouble. Because these pumps are quite light in construction they should be more carefully lined up than centrifugal pumps to eliminate pipe strains that tend to cause misalignment of their parts.

Q 18—What is the maximum viscosity for which these pumps should be used?

A—Up to 400 ssu. As a general rule, above this value, performance falls off so fast that it is not practical to apply these pumps.

Reader's Problems

(*Continued from page* 115)

Look for Impurities In the Liquid Line

REFRIGERANT TEMPERATURE OR PRESSURE, or both, would not be responsible for the erratic valve operation unless the refrigerant contained moisture or impurities. In many instances, I have found no consideration given to the installation of filters in the liquid line, ahead of solenoid valves. Impurities, which are carried along with the refrigerant, accumulate within the valve, causing erratic operation. Other possibilities, however, are open for consideration. I suggest *HF* check to see that: (1) power supply to valves is ample (2) valves are not connected in series and (3) all electrical connections are in good condition. The trouble could be in the thermostat valve. Check its location and position; it may be connected to a conduit that retains heat longer or pushes it out of line. Check differential of cut-in and cutout points. If thermostat is the remote type, check capillary tube.

Astoria, N. Y. CARL BACHMAN

Take It For Granted, a new sound motion picture, has been produced for the New England Power Co by the Jam Handy Organization, Detroit. This picture has a screen time of about 23 min and shows the part that dependable electric power plays in home life and industry of the New England states. Film describes vast development of the company's plants and elaborate provisions made for protection of the power supply in times of emergency. Free showings may be arranged through *John I Ahern, New England Power Co,* 441 *Stuart St, Boston, Mass.*

Plans are under way for observance in 1948 of the 60th anniversary of the Superior Engine Div of National Supply Co.

. . . but totally different at the crank shaft

Boiler feed and other high pressure services reach a new high in efficiency and a new low in cost when Worthington Triplex Power Pumps put the pressure on.

WHICH DO YOU NEED?

Whether you require the constant stroke of the VTE or the variable capacity of the Variflo, you get such efficiency-increasing, cost-lowering features as: totally enclosed power end; pressure lubrication on all bearings except the flood-lubricated main bearings; simple construction without reduction gears; patented flange and screw-type gland; full accessibility to plungers, valves and running parts. A complete range of sizes covers capacities up to 165 gpm in single units.

HOW VARIFLO DIFFERS

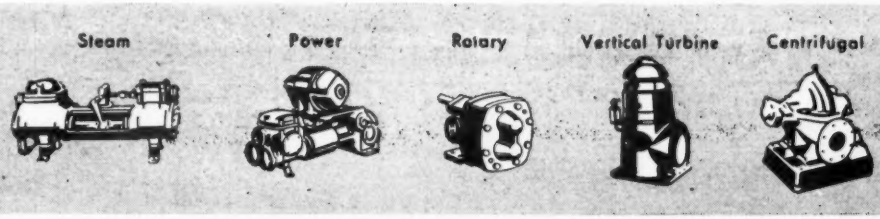
Worthington Variflo Triplex Power Pumps give you automatic, stepless capacity control from 0% to 100% at constant speed. The simple, rugged stroke-changing mechanism, carried in the crank shaft, is the only difference between Variflo and VTE.

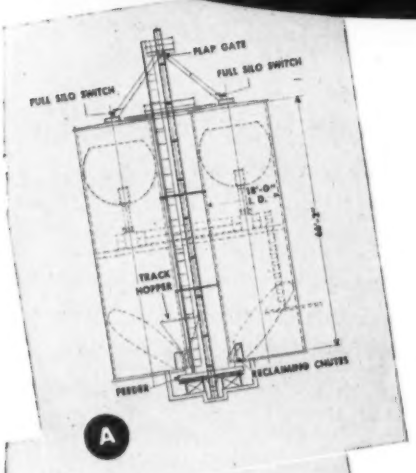
Bulletins, describing how Worthington Triplex Power Pumps achieve dependable operation at minimum costs, prove that *there's more worth in Worthington*. Write for them to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N J.*

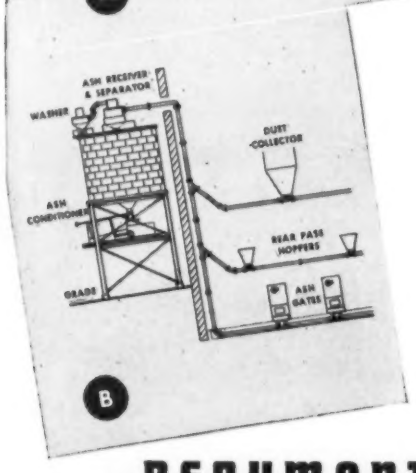
WORTHINGTON

P7-2

THE WORLD'S LARGEST MANUFACTURER OF PUMPS







COAL HANDLING

With Beaumont Birch Coal Handling Equipment, one operator controls all coal from the time it arrives by rail and is dumped in the track hopper, through its lifting by bucket elevator, to its use —immediate or future.

ASH REMOVAL

The Beaumont "Vac-Veyor" system offers the most direct and economical method for removal of ashes, siftings, soot and dust. They are vacuum conveyed through a pipe from their source to an ash receiver and separator—then into the silo where they remain until final disposal.

Beaumont engineers design and erect this equipment—a complete coal and ash handling system. This brings you savings in installation as well as in handling costs—you have one contract, we have sole responsibility.

Write for more information to:

BEAUMONT BIRCH *Company*

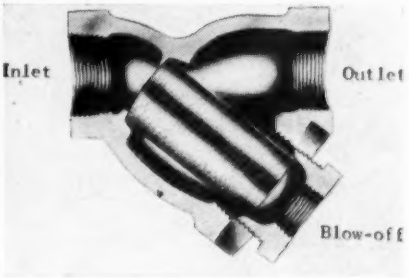
1502 RACE STREET—PHILADELPHIA 2, PENNA.

Designers *Manufacturers* *Erectors* BULK MATERIAL HANDLING SYSTEM

New Equipment

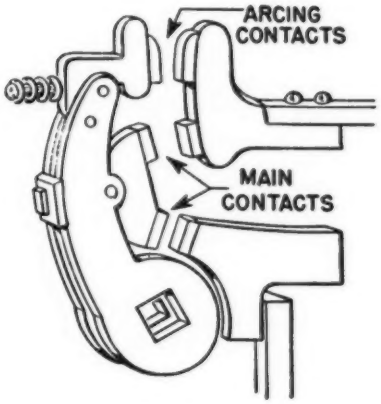
(*Continued from page* 134)

stepless change of output shaft speed and quick reversal (3) hydraulic 2-speed control for remote selection of adjustable preset speeds in either direction (4) electric 3-position remote control for independent adjustable preset speed in either direction (5) standard control devices modified to meet intricate operating characteristics of special applications. Recommended electric motor is 2 to 3 hp at 1750 rpm, 4-hp maximum input. **Oilgear Co, 1301-1417 W Bruce St, Milwaukee 4, Wis.**



Pipeline Strainer E 23

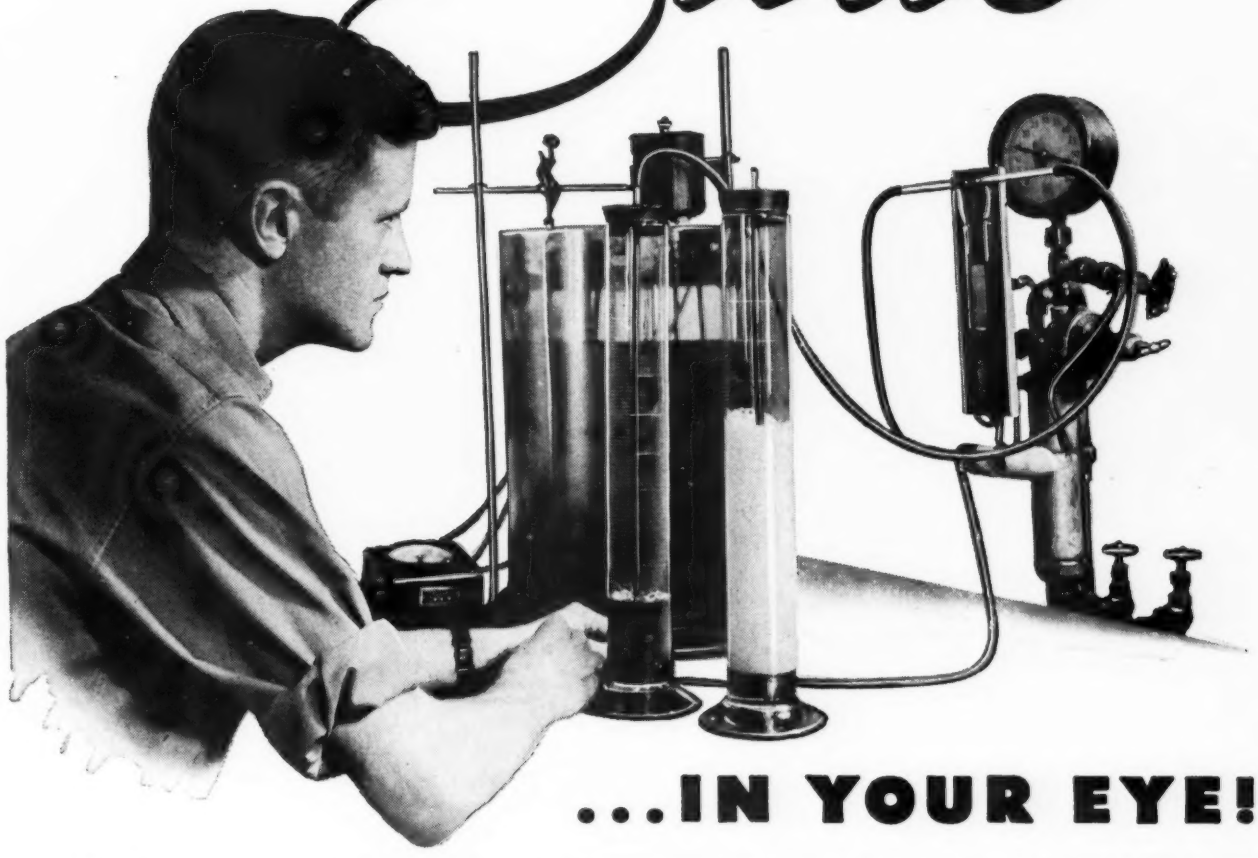
NEW STAINER is suitable for working steam pressures up to 250 psi and temperatures up to 450 F. It serves on cold liquid lines or gas lines at pressures of 400 psi. Free hole area of screen element is from two to four times area of pipe connection, depending upon service for which strainer is used and size of unit. **Wright-Austin Co, 315 W Woodbridge St. Detroit 26, Mich.**



Electrical Contacts E 24

SUPPLIED IN TWO GRADES, the *Gibsiloy M*-10 and *M*-12, silver-molybdenum electrical contacts possess excellent arc-resisting characteristics. *Gibsiloy M*-12 serves on heavy circuit breakers where greater mechanical and electrical stresses are encountered and *Gibsiloy M*-10 is used on smaller units handling lower pressures. *Gibsiloy* silver-molybdenum electrical contacts are suitable for arcing tips in air or oil circuit breakers, also as contacts in other oil-immersed apparatus such as transformer cap changers. Made by the

HERE'S *Suds*



...IN YOUR EYE!

The suds very much in your eye as you look at the photograph above is lubricating oil which foams badly and, if used in valuable equipment, constitutes a hazard to positive lubrication, which can increase maintenance costs.

At Sinclair Laboratories, skilled technicians, like the one shown above, study and test lubricating oils constantly for foaming characteristics. Through research in the study of additives, Sinclair provides anti-foam characteristics and assures positive lubricating film plus maximum heat dissipation for protection against wear and failure.

Through such painstaking research, Sinclair maintains production of lubricants of consistent high quality. Sinclair Laboratories and outstanding research are behind the dependable performance of all Sinclair Lubricants for Industry.

Sinclair Lubricants for the Power Plant

For Turbines:
SINTURLITE OILS

For Steam Cylinders:
SINCLAIR STEAM CYLINDER AND VALVE OILS

For Compressors:
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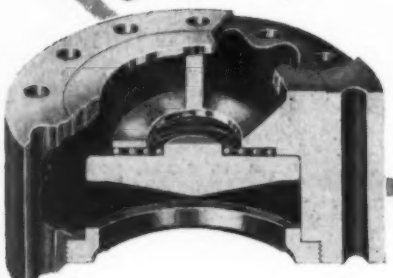
Lubricants for Industry

FINEST CRUDES + EXPERT RESEARCH and MANUFACTURING CONTROL = OUTSTANDING PERFORMANCE

Steel Plants
... are one of the biggest users of THE WILLIAMS-HAGER *flanged* SILENT CHECK VALVES



While hundreds of Williams-Hager Flanged Silent Check Valves are used for various applications—one of the most important is on *High Pressure Descaling System in Strip Mills.* These valves will operate effectively in any position—horizontal, vertical, upside down or angular—and will remain tight under every condition of service and pressure. When "Water Hammer" occurs look to Williams-Hager Flanged Silent Check Valves for the economical answer.

Write for new bulletin!

THE WILLIAMS GAUGE CO.

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Steam Traps . . . Pump Governors . . . Feed Water Regulators . . . Water Columns

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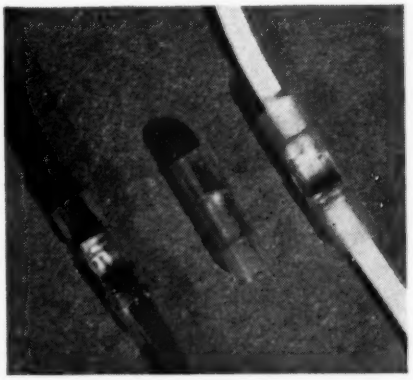
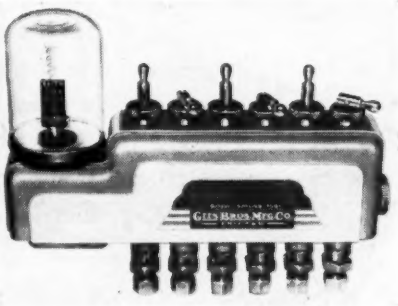
powder metallurgy process, they combine high hardness with good conductivity. These properties result in excellent resistance to wear from arcing and mechanical action. They are made in individually molded shapes for each application, thereby eliminating extensive machining operations and thus conserving materials. They are furnished solder-backed for convenient and dependable brazing. **Gibson Electric Co, 8362 Frankstown Ave, Pittsburgh 21, Pa.**



Insulated Splice E25

MADE OF SEAMLESS BRONZE, this *Sta-Kon* pressure connector No. 25 is protected with a translucent high dielectric plastic insulator. The insulator is impervious to oil, grease, water, chemicals and acids. It is bonded to the conductor and cannot slip or become accidentally detached. A perfect connection is easily obtained with standard T & B *Sta-Kon* hand- or power operated tools. The splice is unique in that a single squeeze of installing tool permanently connects the wires and insulates connector. The connector is available in sizes that accommodate various numbers of wires from No. 14 to 20 awg. **Dept P, Thomas & Betts Co, Elizabeth 1, N. J.**



Multiple Oiler E26

THIS NEW OILER is capable of solving the oiling problems in a wide variety of small shops and large plants. The oiler is a centralized unit made up of a transparent reservoir of unbreakable plastic with a non-spill valve that greatly simplifies refilling. There is also a large main reservoir from which copper tubes lead to remote oiling points. Oil in the main reservoir is maintained at an even level from the plastic constant-level reservoir, which insures a well-regulated flow of oil to individual bearings. This principle also

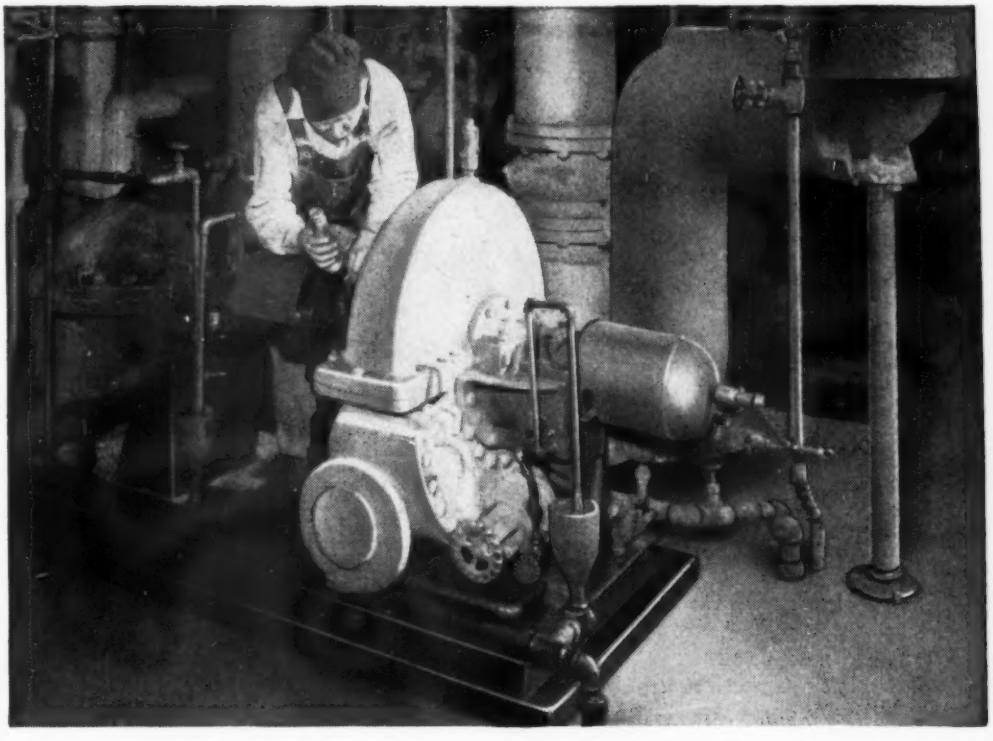
It's G-E Turbine Drive...

FOR SHORT SHIPMENT

Yes, we mean it! Delivery time on our standard, single-stage, shaft-governed turbine drives is approximately **15 weeks.** If you have an urgent replacement problem we can do better than that.

This fast shipment is possible because of the standardization of the basic single-stage line, applicable in general for ratings up to 800 hp. Delivery time of other units is longer depending upon engineering and manufacturing requirements.

FOR LONG LIFE



"Operation and maintenance costs on this turbine have been negligible", reports the chief engineer of the Northeast Station, Kansas City Power and Light Company. On the job since 1941, the turbine has had over 30,000 hours of operation which, during the last two years, has been almost continuous, twenty-four hours a day, seven days a week.

The governor on this turbine controls pump discharge pressure in terms of load requirements on the system. To give maximum economy exhaust steam is used to heat the feed water.

FOR QUICK SERVICE

Servicing is simplified when you operate G-E turbine drive. Twenty-six service shops and 115 sales offices, at strategic locations throughout the nation, provide quick and convenient sources of aid for you.

For the assistance of G-E specialists in the application of turbine drives, get in touch with the nearest G-E Apparatus Sales Office, or write Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

252-18

How does your Power Plant "Measure Up?"

As industry and its problems have become increasingly complex, tremendous advancements have been made in processes and methods. At the same time, many over-burdened facilities have become so strained that they are inefficient and uneconomical.

In today's progressive period, how does your power plant "measure up"? Are power costs and plant reliability as fully up-to-the-minute as process techniques?

The outside viewpoint of capable and experienced engineering specialists, in the form of a power plant survey, can be of inestimable value to the organization confronted with power problems and opportunities.

Kuljian Engineers have specialized for years in power plant design, construction and operation. It will pay you to call on us for assistance in any program looking toward modernization of your facilities. Your inquiry is solicited.

The Kuljian Corporation

ENGINEERS • CONSTRUCTORS

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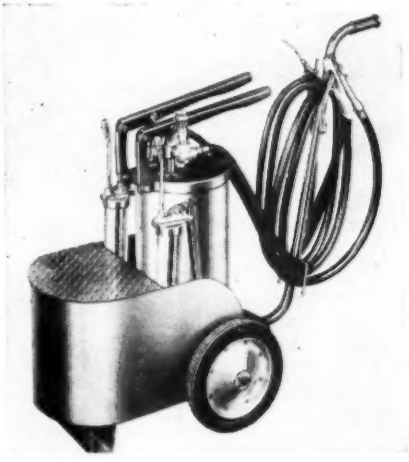
New York 6 • Washington 5

prevents overflow and flooding of bearings. A series valve for each oil lead permits flow to be changed, adjusted individually or turned completely on or off. This makes it possible for the system to serve more than one machine or to serve a complex unit with independently working parts. **Gits Bros Mfg Co, 1846 S Kilbourn Ave, Chicago, Ill.**

pH Meter E27

INDUSTRIAL MODEL, direct-reading pH meter, for measuring acidity and alkalinity, can be used at a bench or table for testing small samples, or as a portable instrument for making spot checks. As a continuous indicator directly on processing operations, meter is suspended over tank or mounted on a wall. Batteries have been eliminated; operation is from any 110-v 50- or 60-cycle ac outlet. A voltage regulator corrects for fluctuations from 100 to 130 v. Compensation is automatic for variations from zero to 100 C. Accuracy is 0.10 pH over the instrument's full range of 0 to 14 pH. **Cambridge Instrument Co, 3007 Grand Central Terminal, New York 17, N. Y.**



Lubricating Cart E28

A COMPLETE LUBRICATION DEPARTMENT on wheels, this service cart needs no air or electric connection. It carries a generous supply of three different lubricants—two greases and one oil. This specially de-

Cutter head speed *is the pay-off*

TOP SPEED UNDER ACTUAL SERVICE CONDITIONS is the way to judge a tube cleaner's ability to do a faster cleaning job. Lagonda tube cleaners have this speed. Their cutter heads *keep on* whirling swiftly when heavy scale tries to slow them down.

POWER—LOTS OF IT—goes right along with these racing, driving cleaners. The Lagonda motor—whether water or air-steam type—is packed full of power—and with reserve battalions of it to jump in when the going gets heavy.

RUGGED CUTTER HEADS PLAY THEIR PART in these faster, more effective cleaners. They're designed and built with the finest materials, with cutters that hold their edges, and vital parts especially heat-treated to insure proper hardness so that they stand up under this extra operating speed and power. Trackless cutters insure against tube injury as well as positively removing every trace of scale.

Use Lagonda Cleaners for tubes straight or curved, large or small. They do a faster, better, all-around job. The bulletin tells why—Write for it today.

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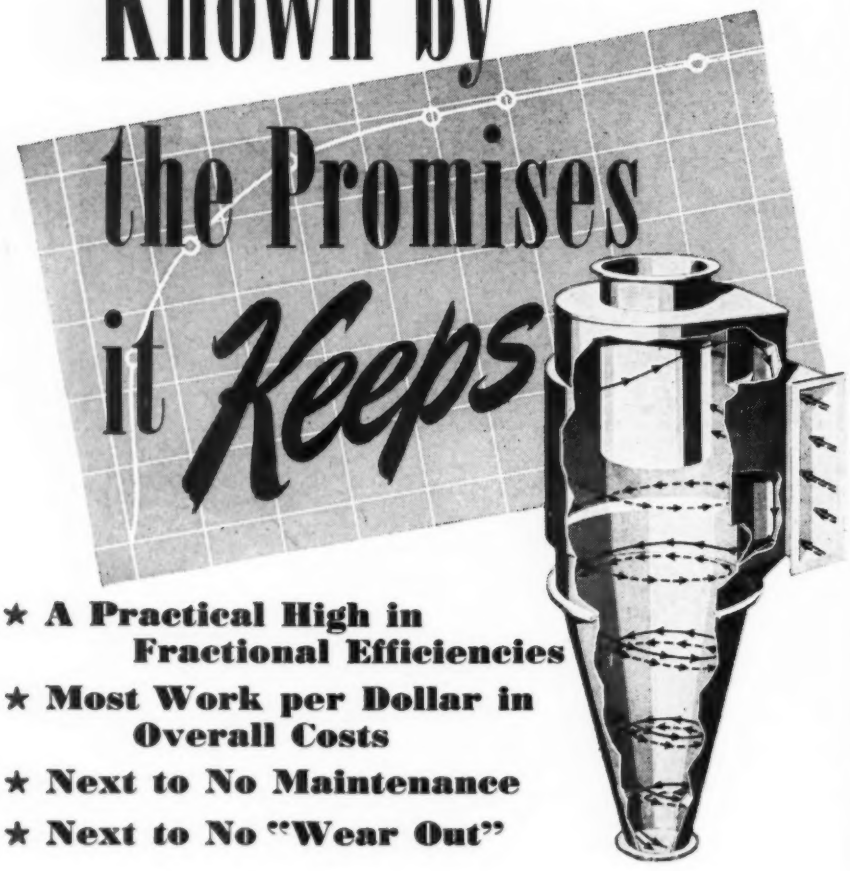
Lagonda TUBE CLEANERS

Y-265

Known by the Promises it Keeps



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★ **Most Work per Dollar in Overall Costs**

★ **Next to No Maintenance**

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Ten years and more of Buell van Tongeren Cyclone performance in dust control and recovery, in a wide spread of American industries, lays indisputable evidence on the line.

The principle of the cyclone is essentially simple. But it remained for the van Tongeren patent to add real operating efficiencies in handling dust particles of micron-size fineness. Here for all to see is the unique Buell cyclone . . . with practical operating efficiencies a matter of Industry record.

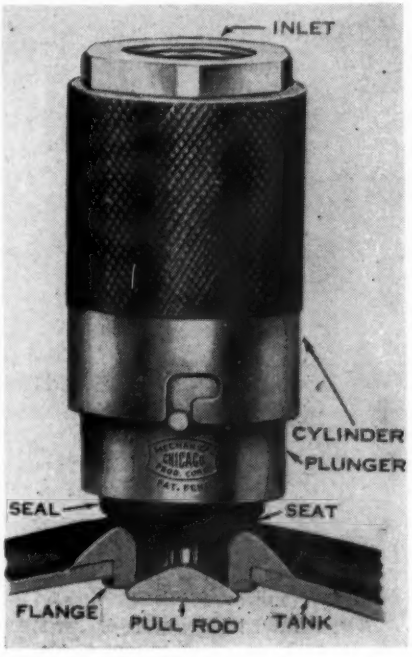
To every engineer and businessman currently devoting time and thought to a particular problem of dust control or recovery, we offer the Buell fund of practical information. A most useful engineering perspective will be opened up by a study of our new book "Engineered Efficiency in Dust Recovery". A copy is yours for the asking. Write: Buell Engineering Co., 10 Cedar Street, New York 5, N. Y.

buell

Engineered Efficiency in DUST RECOVERY

signed one-man portable unit makes systematic multibearing lubrication practical and profitable. Cart is lightweight, sturdy and compact. Unit is mounted on two semipneumatic tires. It is easily maneuvered between closely placed machines and speeds production by reducing lubrication time.

Two one-lb lever guns and one half-pint pistol oiler are included. Pressure pump has built-in gun loader for the hand-operated grease guns. All compartments are easily filled without removing pump. Front section of cart incorporates a large tool box with hinged lid that also serves as a platform step. **Industrial div, Gray Co, Graco Sq, Minneapolis 13, Minn.**

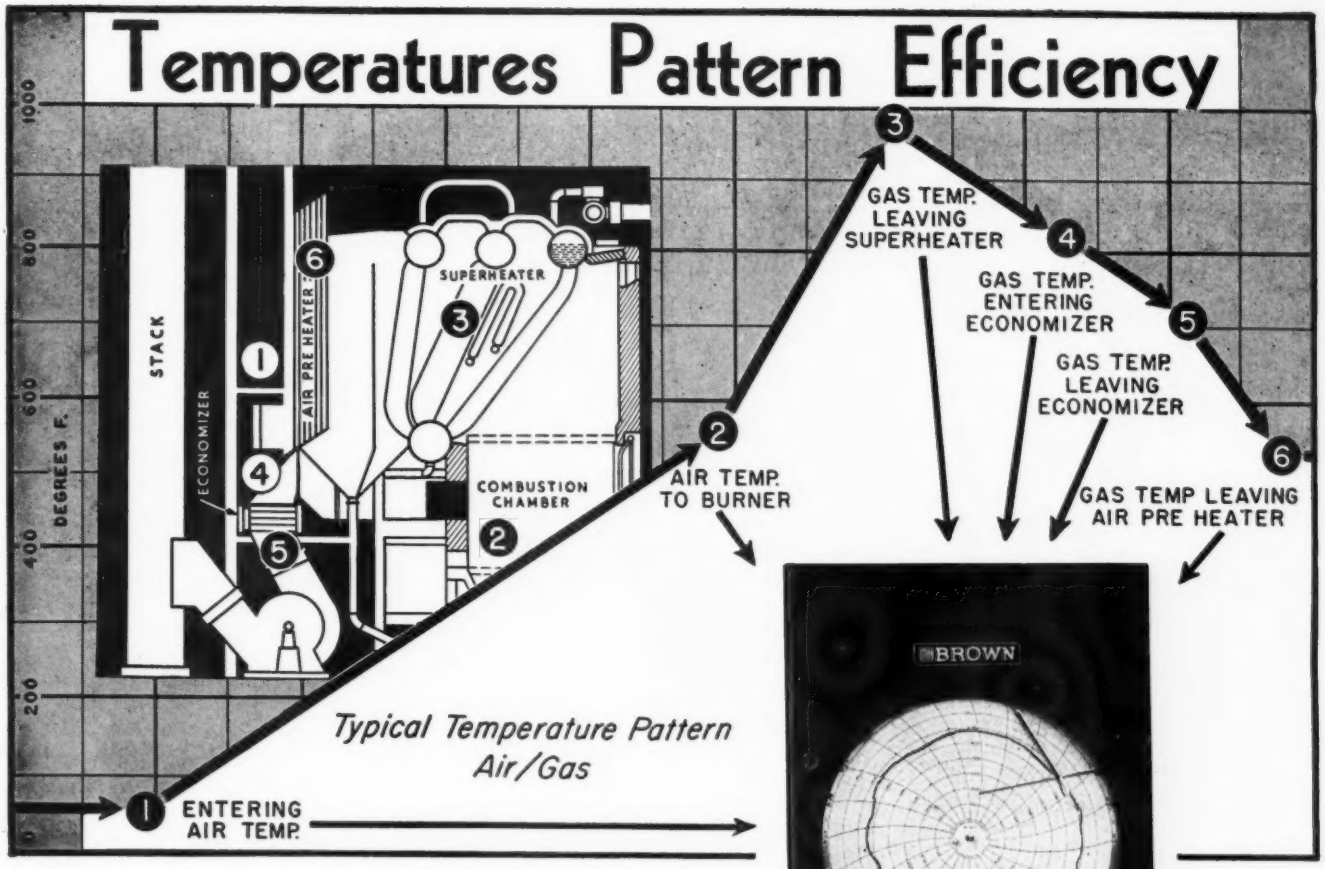


Filling Connector E29

HYDRO-MATIC self-sealing filling connector can be used to fill tanks, boilers or other receptacles with air or liquid for making hydrostatic or pneumatic internal-pressure tests. Device can be used to attach pressure lines to plain or threaded pipe openings. Self-sealing feature is accomplished by a greater pressure area being provided against the plunger and seal than the backpressure area through tank opening, thus forcing and holding the seal firmly against seat until pressure within tank is released. Standard sizes, suitable for testing pressures up to 500 psi, made with ½, ¾ and 1-in. pipe inlets, and adaptable to ¾, 1 and 1¼-in. pipe openings, are available from stock. Other sizes are made to order. **Mechanical Products Corp, 168 N Ogden Ave, Chicago 7, Ill.**

Air-Operated Humidifier E30

NEW ATOMICK HUMIDIFIER is designed particularly for industries where year-round maintenance of proper humidity is vital to production and uniformity of product. A single spray unit atomizes up to 1¼ gal of water per hr, while the 4-spray model handles four times as much. It is air-operated. The device can be successfully



Brown Thermometers increase efficiency . . . at every step

The above pattern shows air/gas temperatures for a typical boiler. Maintaining this temperature pattern at each step from the air intake to the stack is important for high boiler efficiency.

By having a continuous record of these important temperatures, your power engineer can maintain high efficiency. Without them, he is operating in the dark . . . inefficiencies show themselves only in unexplainably high power costs.

Brown Recording Thermometers for these points are an economical investment for large or small power plants. The advanced design of these instruments provides a degree of accuracy and utility never before offered in a thermometer. The special heat treating and stress relieving of the spiral actuating elements alone is an achievement in manufacturing that means better performance to you. Brown Thermometers last for years and years . . . but pay for themselves quickly in lower power costs.

Your local Brown Engineer will be glad to discuss these steps to increased power plant efficiency with you. Write for further information. Send for your copy of Catalog 6708 describing Brown Recording Thermometers.

Write for Catalog 6708

The Brown Instrument Company, 4490 Wayne Avenue, Philadelphia 44, Pa.

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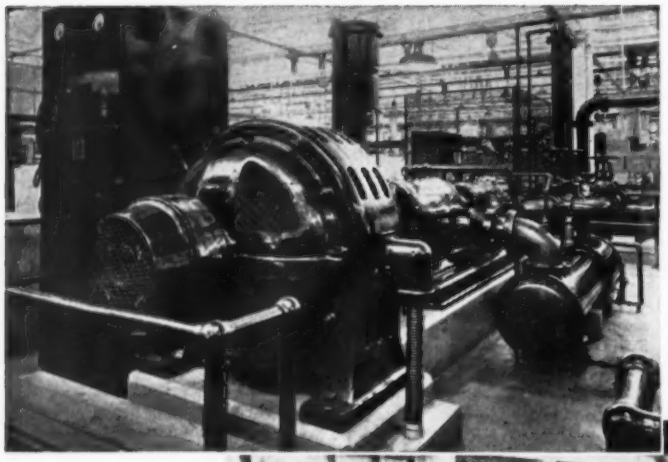
MH BROWN THERMOMETERS

INDICATING . . . . RECORDING . . . . CONTROLLING



43 Fuller Rotary Compressors Purchased Since 1939

Starting in 1939, one of the largest manufacturing companies of the country purchased its first Fuller Rotary Compressor. Satisfactory performance of the initial installation has led to many additional orders. Up to the present time, 43 Fuller Rotaries have been purchased and installed by the customer in its many plants throughout the country.

The majority of machines installed in these plants are of the two-stage type, operating at 125-lb. pressure, such as illustrated above.

These machines will serve for many years to come because, they're built for long, continous service . . . few working parts, none to adjust. In addition, due to design and construction, a Fuller Rotary maintains its original capacity for the life of the machine.

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA

Chicago 3 - 120 So LaSalle St.
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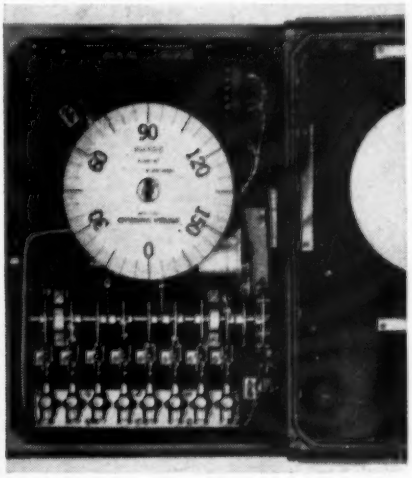
FULLER COMPANY

FULLER-KINYON, FULLER-FLUXO AND THE AIRVEYOR CONVEYING SYSTEMS
ROTARY FEEDERS AND DISCHARGE GATES ROTARY AIR COMPRESSORS
AND VACUUM PUMPS AIR QUENCHING INCLINED GRATE COOLERS DRY
PULVERIZED-MATERIAL COOLER AERATION UNITS MATERIAL LEVEL
INDICATORS MOTION SAFETY SWITCH SLURRY VALVES SAMPLERS

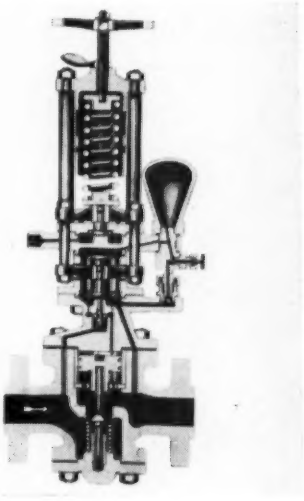
C-143

employed for atomizing and dispensing any liquid that flows freely through pipes. **Maid-O'-Mist, Inc, 3218 N Pulaski Rd, Chicago, Ill.**



Time-Cycle Controller E31

MODEL C-500 impulse-sequence cycle controller has been developed for timing mechanical operations in industrial processes. Instrument is suitable where numerous operations must be accurately timed according to a fixed program. Time measurement and pilot valve operation are handled by separate mechanisms. Separation of these two basic functions makes possible a design that gives accurate timing of the factors under control, high speed and torque for pilot valve operation and flexibility of application. Timing is by a *Telechron*-driven aluminum disk on which is printed a 25-in. time scale. Desired schedule of operation is incorporated into the controller by cutting notches on time scale. Cams are individually adjustable and their setting does not require fine adjustment to get accurate results. **Bristol Co, Waterbury 91, Conn.**



Pump Governor E32

LINE OF PUMP GOVERNORS is designed for high accuracy and for resisting wear and erosion. Main valve has hard-surfaced seat rings of 800 brinell stainless steel and 500

LADISH

Controlled Quality

...WHAT IT MEANS IN DEPENDABILITY AND LONG SERVICE FROM PIPING SYSTEMS

Controlled Quality is the distinguishing feature of every product in the complete Ladish line. Seamless Welding Fittings, Forged Steel Fittings and Forged Steel Flanges . . . all are produced under exacting metallurgical control and rigid inspection of physical dimensions.

Ladish Controlled Quality . . . made effective by one of the most modern and completely equipped metallurgical engineering laboratories in the industry . . . provides complete determination of chemical composition and physical properties of steel together with constant application of proper forging procedures and heat treating.

Thus users of Ladish Fittings and Flanges obtain high dynamic strength . . . uniform toughness . . . and assured resistance to shocks, strains and stresses common in piping installations. Advantages resulting from Ladish Controlled Quality provide the ultimate economy of long life and dependability.

A COMPLETE LINE PRODUCED UNDER ONE RESPONSIBILITY

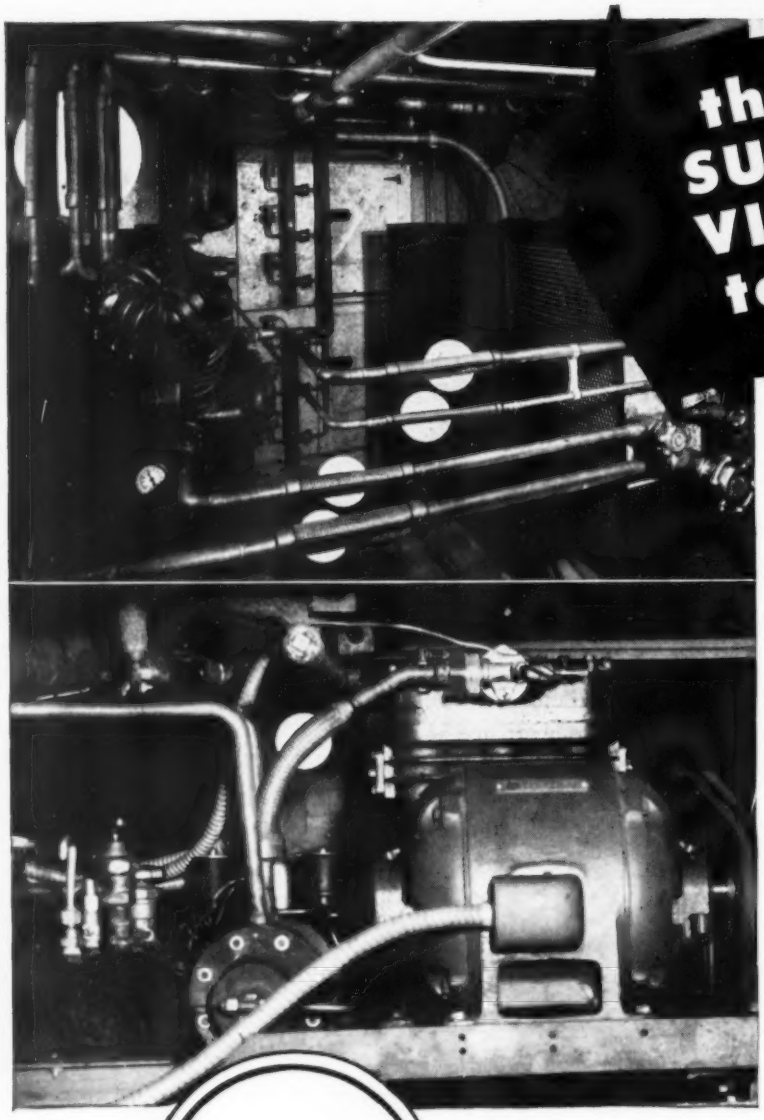
Ladish catalogs, to assist in the design of piping installations and the proper selection of fittings and flanges, will be supplied upon request.

TO MARK PROGRESS

Controlled Quality
FITTINGS
LADISH CO.
CUDAHY, WISCONSIN
MILWAUKEE SUBURB
DISTRICT OFFICES:
New York • Buffalo • Pittsburgh • Cleveland • Chicago • St. Louis • Atlanta • Houston • Los Angeles

... for high and low frequency

VIBRATION DAMPING



there's a REX SUPER-SERVICE VIBRA-SORBER to fit the Job!

Absorbing vibration near its source with Rex Super-Service Vibra-Sorbers is the *sure* way to prevent the damage vibration can cause to pipe lines and connected equipment.

High or low frequency vibrations are effectively handled by the proper Rex Vibra-Sorbers. Sizes and types are available to meet a wide range of temperature, pressure and corrosion conditions. The "Super-Service" prefix denotes proven dependability in tough operating conditions . . . Made possible by CMH engineers' thorough knowledge of the Science or FLEXONICS.*

Write today for details on Rex Super-Service Vibra-Sorbers to eliminate vibration damage and dampen noise in your plant.

FLEXONICS at work!

*the science of FLEXONICS . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

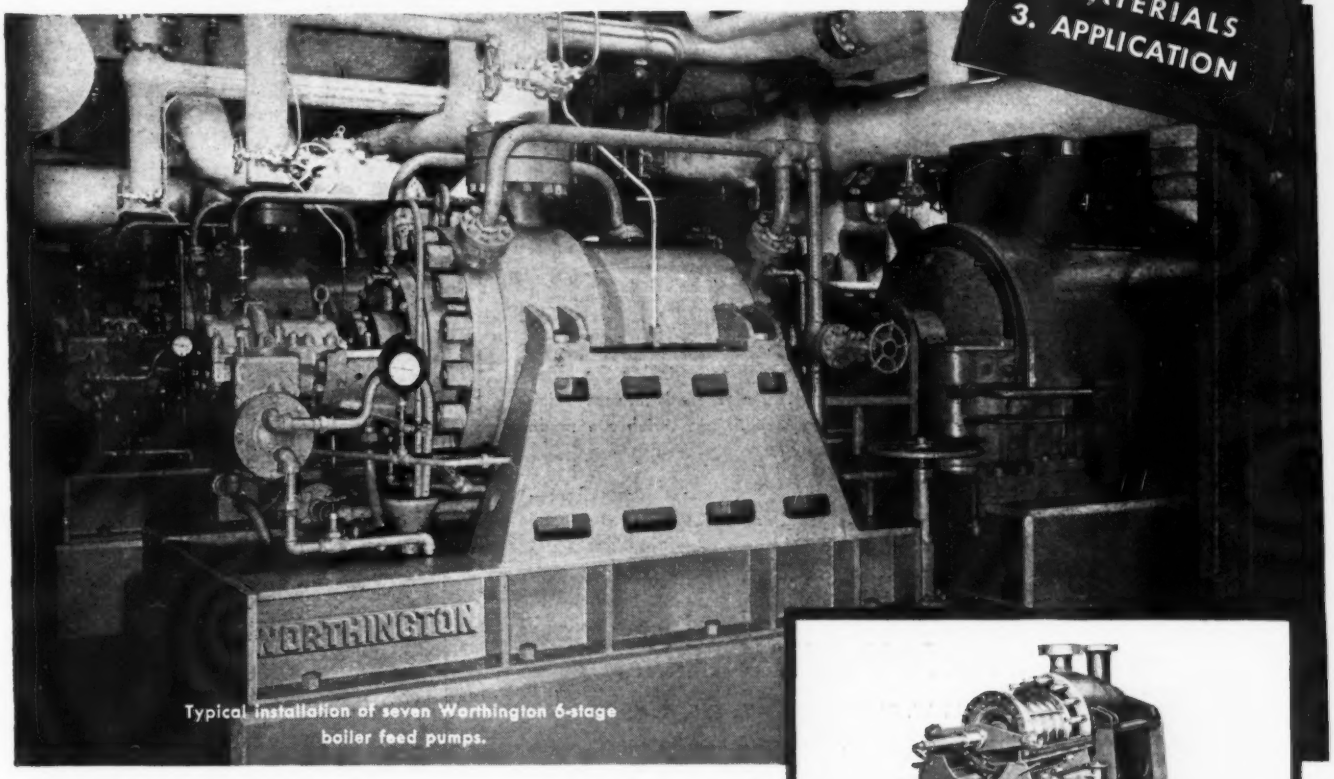
"FLEXON" *identifies C. M. H. products, which have served industry for more than 45 years.*

CHICAGO METAL HOSE CORPORATION

Maywood, Illinois • Plants: Maywood and Elgin, Illinois

WHY WORTHINGTON HIGH-PRESSURE PUMPS *excel in all three . . .*

1. DESIGN
2. MATERIALS
3. APPLICATION



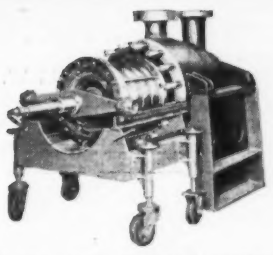
Typical installation of seven Worthington 6-stage boiler feed pumps.

1. DESIGN —Worthington has longer experience in manufacturing high-pressure centrifugal boiler feed pumps . . . has acquired unique constructive ideas from power-plant operating engineers. That's why you'll find such superior design features in Worthington high pressure boiler feed pumps as: a balancing device construction that minimizes wear; bolted ring-type pressure joints; impellers shrunk on the shaft; oversized Kingsbury thrust bearings.

2. MATERIALS —Worthington has greater facilities for research. That's why you'll find the *right* materials in Worthington high-pressure boiler feed pumps: stainless steel for internal parts—to prevent destructive corrosion and erosion; forged steel casings—tested and proved by years of power plant operation.

3. APPLICATION —Worthington Pump Application Engineers are thoroughly versed in every phase of applying the most complete line of boiler feed pumps for high or low pressures — capacities from 50 to 3500 GPM . . . pressures from 50 to 2500 PSI. That's why Worthington will fit the *right* feed pumps to your feed cycle.

For further details on Worthington High-Pressure Boiler Feed Pumps . . . or for an appointment with a Worthington P.A.E.*, write us or telephone the nearest of our 36 district offices. You'll find



AS EASY TO DISMANTLE AND ASSEMBLE AS A SPLIT-CASE PUMP

Complete rotor assembly of Worthington High-Pressure Boiler Feed Pump can be withdrawn *in one piece* on a portable assembly truck without disturbing suction or discharge piping connections. Simplifies inspection, replacement or repair of internal parts.

that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

*Pump Application Engineer

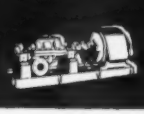
WORTHINGTON

THE WORLD'S LARGEST MANUFACTURER OF PUMPS

For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1000 Ft.

For Hotwell, Condensate, Chilled Water Service
Capacities to 1400 GPM
Heads to 650 Feet

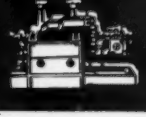
For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1600 Feet

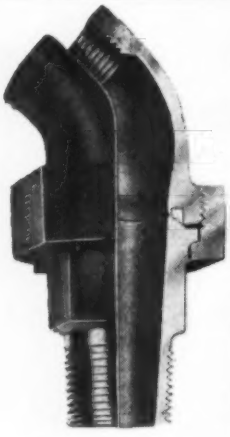


For Water Works, Circulation, Drainage, General Service
Capacities to 135,000 GPM
Heads to 400 Feet

For Boiler Feed Service
Capacities to 1600 GPM
Heads to 3500 Feet

For Boiler Feed Service
Capacities to 3000 GPM
Heads to 7000 Feet





JEFFERSON offers the RECESSED BRASS SEAT . . . providing SURFACE CONTACT and LEAKPROOFNESS IN SPECIALTY UNIONS

The Jefferson 45° Union Elbow is a time, money and space saver taking the place of a straight union, nipple and 45° Elbow. It is typical of the advantages which can be realized through the use of Jefferson Specialty Unions which are made also in 90° Elbow and Union Tee types.

All Jefferson Unions have been developed around the Recessed Brass Seat—a construction which provides a straight-through, metal to metal spherical ground joint, leak-tight without excessive wrench pressure. Furthermore the recessed location of the seat provides complete protection from injury should threaded pipe ends be screwed in too far.

JEFFERSON UNION COMPANY

Consult your nearest distributor—or write us direct—for further information or for your requirements.

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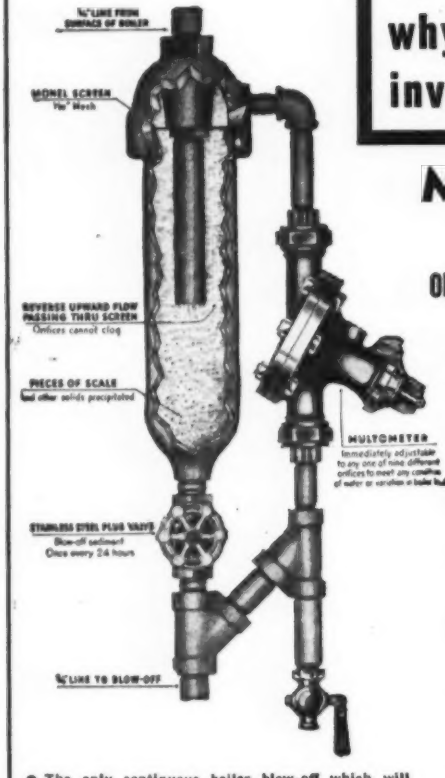
Lexington 73, Mass. Lockport, N. Y.



MANY REASONS why it will pay you to investigate . . . . . .

MULTOMETER SYSTEM
OF CONTINUOUS BOILER BLOW-OFF

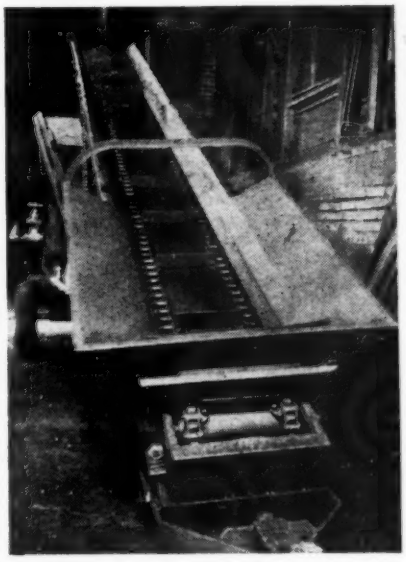
- A reduction in your fuel costs
- Savings in operation and maintenance
- Increased efficiency of steam generation
- An end to wet steam foaming and priming
- Continuous removal of impurities and sludge as accumulated
- Boiler concentration and chemical balance maintained as desired

—and other benefits

• The only continuous boiler blow-off which will neither cut out nor wear out in regular service. Engineered for use with every kind and size of boiler and every character of feed water.

P. E. MADDEN & COMPANY
352 W. WALTON ST.
CHICAGO 10, ILLINOIS

brinell cylinder liner that reduce wear where it occurs most. Hard seat surface is applied as welded sections to seat rings of bronze governors and to main body of steel governors. Pump has instrument regulation accuracy, according to manufacturer, wide spring range that permits settings without change of spring or diaphragm, single-seated valve and no packing or stuffing boxes. Parts are interchangeable without removal of valve body from pipeline. Pump is available in ½ to 4-in. sizes for inlet pressures of 40 to 600 psi at 750 F. **Leslie Co, 50 Delafield Ave, Lyndhurst, N. J.**



Flight Conveyor E33

PORTABLE FLIGHT CONVEYOR for moving materials up steep inclines is available in 14- to 20-ft lengths. It handles bulk materials, such as coal, dirt, ashes, grain and similar products, up inclines of 45 deg or less. Conveyor can also handle hot materials. It has 2-in. flights bolted to steel roller chain, on one-ft centers, to insure minimum roll-back of load. Power is furnished by electric motor or gasoline engine, which will handle up to 60 tons per hour of 50-lb-per-cu-ft material. Maximum discharge height is 14-ft, minimum 4 ft. Speed is 100 ft per min. Over-all frame width is 13¾ in., trough width 10¼ in. Conveyor has combination trailer and hydraulic lifting device for easy moving from one job to another and for quick adjustment of conveyor angle. **Material Movement Industries, 310 S Michigan Ave, Chicago 4, Ill.**

Disconnect Reflector E34

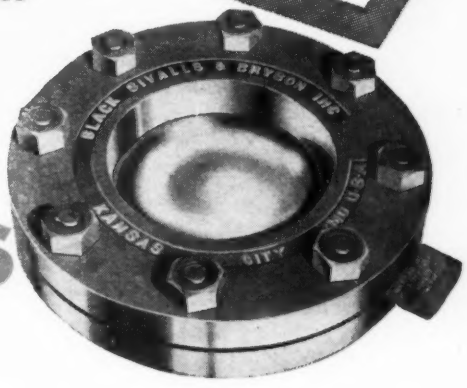
DESIGNED FOR INSTANT ATTACHMENT OR removal to simplify cleaning, this *Diskonect* reflector is equipped with a spring lock that a mere thumb pressure releases. Only one hand is necessary to release the thumb latch. Reflector, socket and lamp are removed as a unit. All parts are quickly and easily disassembled by a spring-mounted socket. The come-apart construction permits cleaning of all parts separately.

To attach the *Diskonect*, press reflector

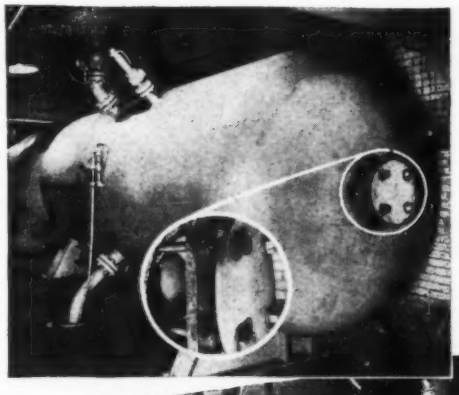
Are You Risking Losses from

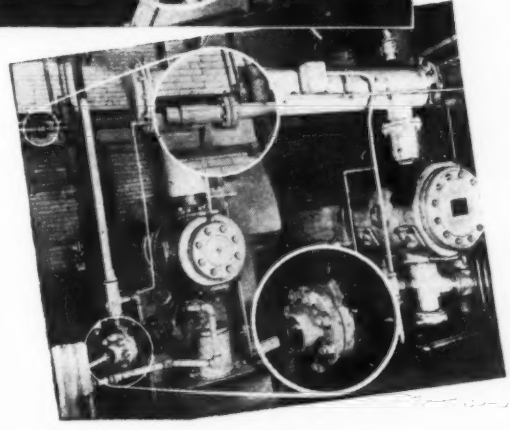
COMPRESSED AIR EXPLOSIONS?

There's Complete Protection Against Over-Pressure in BS & B SAFETY HEADS



Don't scoff . . . compressed air systems do explode! Insurance company records offer proof. Vaporized oil-air mixtures touched off by a fleck of hot carbon, leaky discharge valves allowing hot air to be drawn back into the system, clogged intake filters overheating compressors . . . all these mean trouble. Inter and after coolers eliminate many dangers . . . relief valves handle normal pressure rises. But it takes SAFETY HEADS for that positive margin of safety. Yes, sir, SAFETY HEADS act instantly, even to high speed pressure waves! Provide, full, pipe-size unrestricted relief opening.





Thousands of Installations Prove Effectiveness of SAFETY HEADS

No other pressure relief device offers such complete protection with such economy. No other device can approach the relief capacity of a SAFETY HEAD in a given diameter. The simple rupture diaphragm bursts in tension at pre-determined pressure and temperature. You'll be amazed at their versatility . . . 5 to 25,000 psi . . . a size for every need. Quickly and easily replaced.

Your plant, like the Central New York Power Plant at Oswego, pictured at left, can profit from the protection of SAFETY HEADS. Write today for complete information and specifications. Address the Special Products Division, Black, Sivalls & Bryson, Inc., Power and Light Building, Kansas City 6, Missouri.

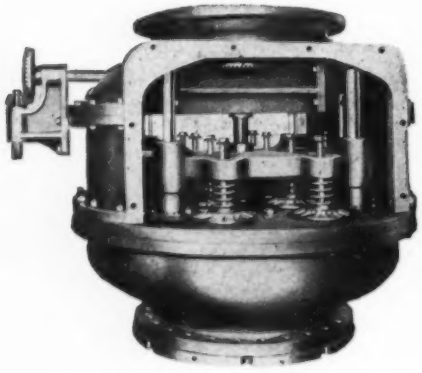
FOREIGN INQUIRIES INVITED — Cable Address: BLACK, KANSAS CITY, U.S.A.

EFFICIENCY RELIABILITY

BLACK, SIVALLS & BRYSON, INC.

KANSAS CITY, MO. — OKLAHOMA CITY, OKLA.
CASPER, WYO. — CALGARY, ALTA.

When Teddy ran on the Bull Moose ticket in 1912



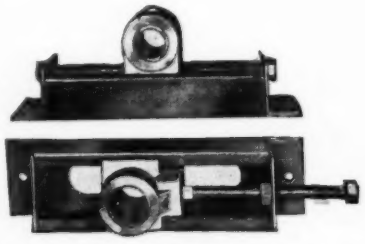
a manufacturer purchased this 30" Cochrane Multiport Valve for 6 lbs. back pressure relief service. For 32 years, this valve was in practically continuous service. Not a single replacement part was furnished nor a single repair made, but in 1944 the customer decided to return it for general overhaul. Very little reconditioning was necessary and the valve was put back in service.

COCHRANE CORPORATION
3106 N. 17th Street, Philadelphia 32, Pa.
Write for a copy of Publication 4150.

Safety, silence and tightness are the outstanding characteristics of the Cochrane Multiport Relief Valve in addition to its long-lasting qualities.

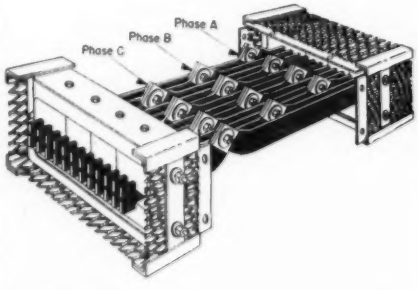
MULTIPORT RELIEF VALVE

back into hood where it clicks and locks securely in place. Because mechanical and electrical connections are completed at the same instant, it lights as it locks. Finished in permanent porcelain enamel, *Diskonect* is available in a wide variety of styles and sizes. It has a universal terminal base to fit both medium and *Mogul* sockets. This makes it possible to change lighting equipment to meet new conditions without changing hood. The reflectors are interchangeable with three styles of hood for pendant, right-angle or ceiling mounting. **Goodrich Electric Co, 4600 Belle Plaine Ave, Chicago, Ill.**



Belt-Conveyor Takeup E35

PATRON BELT-CONVEYOR TAKEUP is built with pressed-steel frame for compactness, light weight combined with high strength. A corrosion-resistant bearing housing fabricated of heat-treated aluminum alloy supports sealed-type porous-bronze *Ledaloyl* self-lubricating bearing. Sizes range from 5/16 to 1 5/6 in. in types *A* and *B*. Takeup travel is 6 in. **Dept 105, Patron Transmission Co, 129 Grand St, New York 13, N. Y.**



Feeder Bus E36

SPECIFICALLY DESIGNED for connecting long runs of large ac equipment, this insulated feeder bus is produced in three types: 2-pole single-phase, 3-pole three-phase, and three-phase four wire. The bus is available in 800, 1000, 1350, 1600 and 2000 amp capacity. Protected by an expanded steel mesh on all sides, busbars are wrapped and insulated to assure the least possible temperature rise. This construction gives minimum weight and maximum heat dissipation. To insure easy and fool-proof method of joining the 10-ft sections, the silver-plated ends of individual busbars are bent outward, edgewise at 45-deg. angle. Cable lugs or other busbar connections can be bolted at these joints for desired take-off. **National Electric Products Corp, Chamber of Commerce Bldg, Pittsburg, Pa.**

BOOST vacuum! SAVE coal

Descale Condensers the Oakite Way!

HERE'S how to bring up vacuum readings, reduce condensate temperature, cut coal costs: Descale waterside of condensers by circulating recommended solution of Oakite Compound No. 32, the inhibited, acidic-type descalant.

Here's Proof!

One Indiana public utility found they could descale condensers without taking them off the line, using the fast, penetrating action of the Oakite descalant to dissolve lime scale formations on tube surfaces. One day's saving in coal more than paid for the Oakite compound treatment.

FREE! Descaling Data

Write on letterhead for free 16-page Oakite Digest for power plant engineers. Various descaling procedures are described. No obligation.

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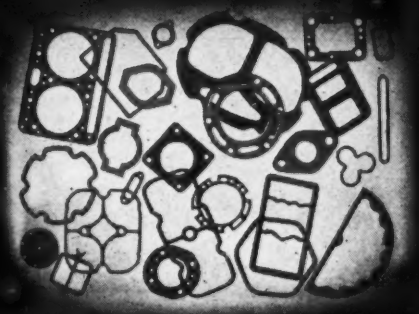
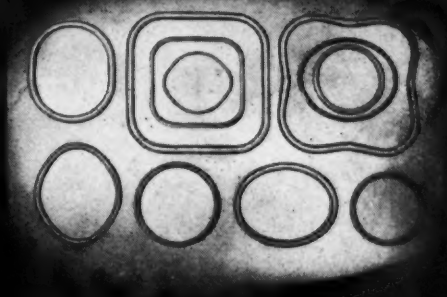
Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

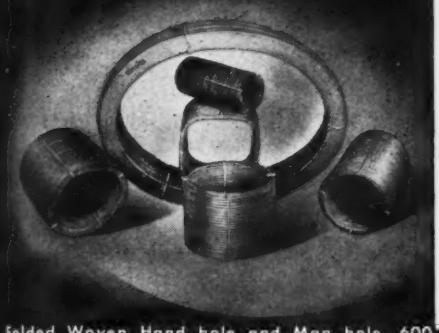
Seamless Asbestos. Man hole and Hand hole.



Special Metal Odd Shaped Gaskets.



Steel Armored Tube and Tube Cap.



Folded Woven Hand hole and Man hole. 600

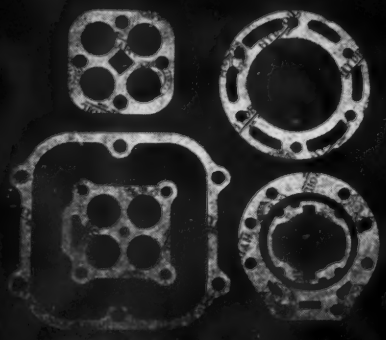
THE ANCHOR PACKING CO.

GASKETS

FOR EVERY INDUSTRIAL PURPOSE

Ankotalic Gaskets. Tube and Tube Cap.

Gasket Tape Woven.



Cut Hydrail.

Corrugated Asbestos Filled Gaskets. Copper, Steel, Monel Metal, Etc.

BOILER GASKETS

Woven Asbestos Gaskets to fit practically every boiler made.

GASKETS CUT FROM SHEETS

Our gasket factory is prepared to supply gaskets of any shape, cut from a wide variety of gasket sheets to meet any requirements.

SPECIAL METAL GASKETS

Furnished to meet any special gasket problem.

Convenient Warehouse Locations with stocks for immediate shipment

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FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

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5575 Cote St. Paul Road	Montreal 20, Canada
418 Common Street	New Orleans 4, Louisiana
100 6th Avenue	New York 13, New York
401 North Broad Street	Philadelphia 8, Pennsylvania
405 Penn Avenue	Pittsburgh 22, Pennsylvania
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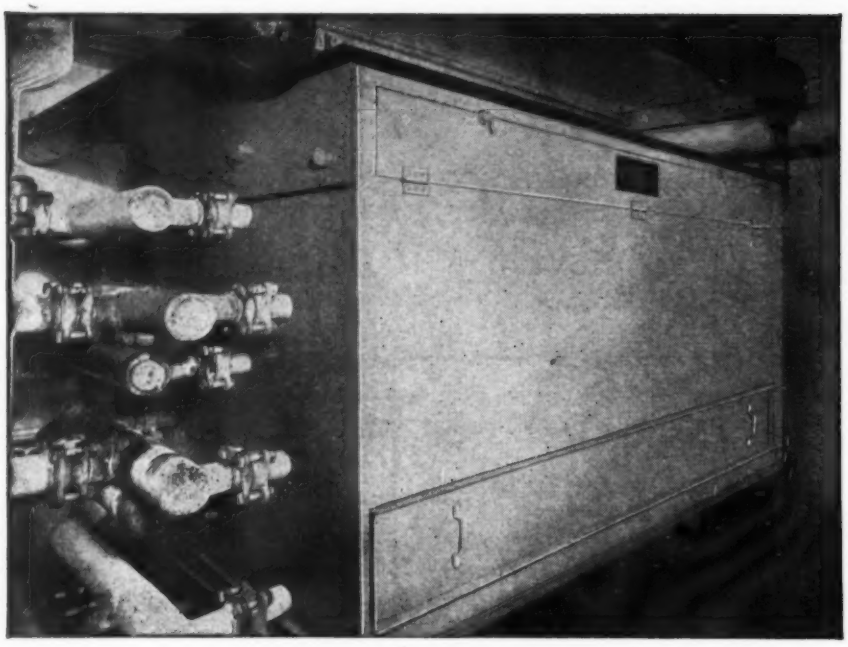
156 South Park	San Francisco 7, California
2207 1st Avenue South	Seattle 4, Washington
1407 Pine Street	St. Louis 3, Missouri
921 South Richmond Street	Tulsa, Oklahoma
524 Avalon Boulevard	Wilmington, California



Chilling Water or Liquids With Accurate Control of Temperature

Regardless of either variation in the cooling load or intermittent operation, the new Niagara Liquid Cooler holds the delivered temperature accurately at the required point. It will deliver fresh water at 33°F. constantly without danger of freezing damage and produces lower temperatures accurately in non-freezing chemical liquids and solution.

Capacity range in available models is from 24 to 465 gallons per minute. High capacity and fast chilling are provided in extremely compact space. The cooler is reliable and easy to maintain; all parts are accessible for cleaning; insulation is easily applied; operation is economical of power and refrigeration.

Write for Bulletin No. 100-P

NIAGARA BLOWER COMPANY

Over 30 Years' Experience in Industrial Air Engineering

405 Lexington Ave. NEW YORK 17, N. Y.

Field Engineering Offices in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Power News

(*Continued from page* 142)

A major expansion program is being started at the Hanford plutonium production plant—the key unit in manufacturing bombs. New chemical plants are being designed for separating synthetic plutonium from natural uranium. "Improvements" to the plutonium-producing units themselves—the atomic piles—are also planned.

Development and production of new weapons using atomic explosives centers at the Los Alamos laboratory in New Mexico. Although the commission stresses the secrecy of this work it also reveals, for the first time, that an atomic pile using "enriched" uranium (containing a higher than normal proportion of fissionable material) is in operation there.

The AEC has little that is encouraging to say on production of power from atomic piles. It is described as a long-term goal—now long, it would be "speculative" to estimate.

One area of peaceful application in which AEC can report substantial progress is the provision of radioactive materials for research use in a wide variety of fields. In the year since distribution began, more than 1000 shipments have been made to experimenters, including radioactive forms of more than 60 of the 96 known elements.

These radioactive materials, chemically identical with the ordinary stable elements, have been of some direct therapeutic use but their principal importance has been as tracers. Because they emit radiation, which can be detected even in minute quantities by electronic instruments, these materials are "tagged" and can be identified as they move through mechanical, chemical or biologic processes.

An outstanding feature of the isotope program has been the large amount of industrial research undertaken. So plentiful has been the supply produced by the atomic pile at Clinton Laboratory that all "feasible" programs submitted by industry have been supplied.

Board of Public Utilities of Jamestown, N. Y., has received three bids for a new turbine-generator, to be installed at the municipal power plant, whose cost will be over $600,000. Allis-Chalmers Mfg Co submitted two bids, one for $625,530 and an alternate of $570,352. General Electric Co bid $623,600, and Westinghouse Electric Corp $624,100. The bids were referred to the Board engineers for tabulation and recommendation.

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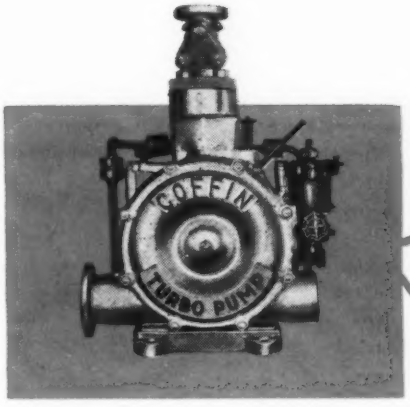

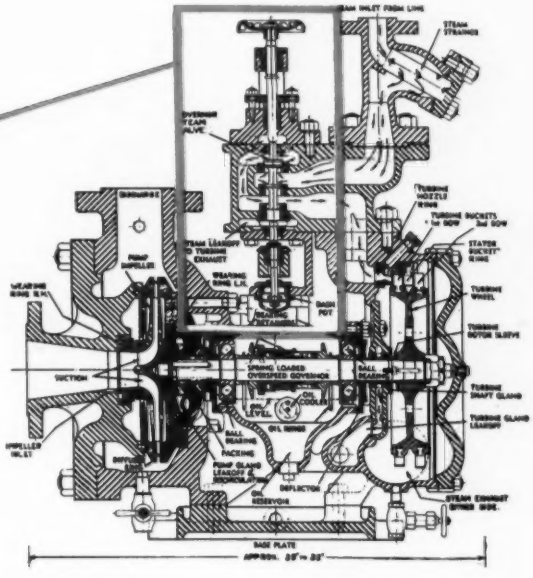

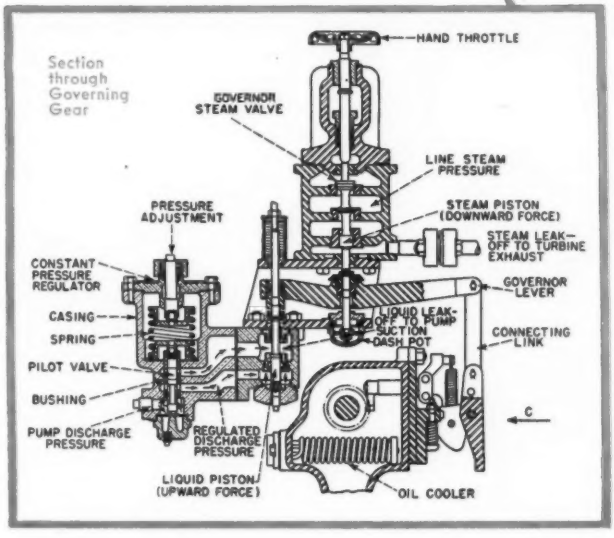

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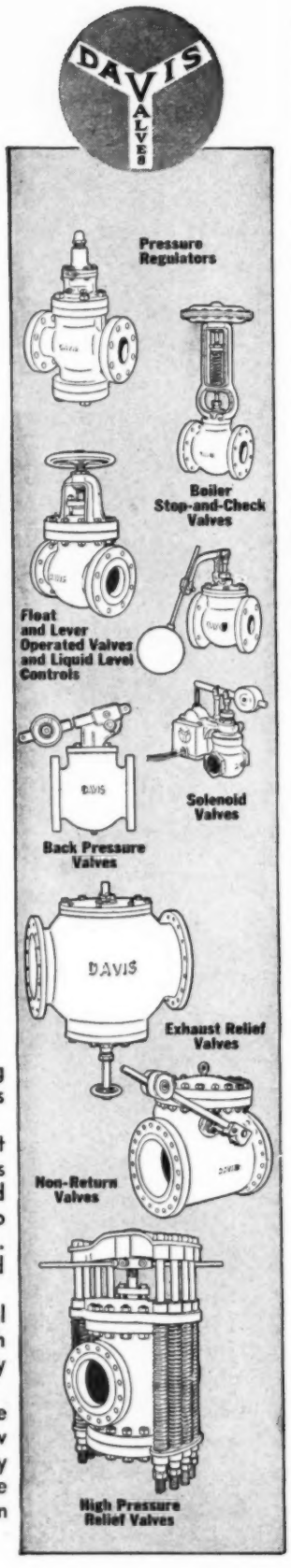

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New Laboratory Tests Gas Turbines for Army

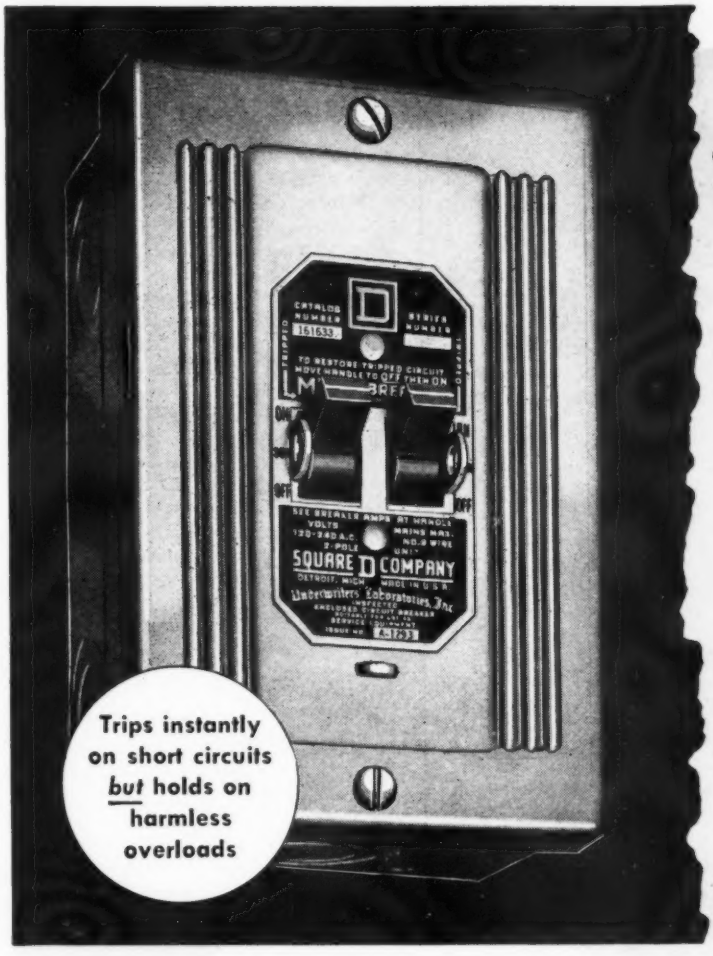
Operation for Army Air Forces of an aircraft gas-turbine engine laboratory, the largest ever operated by private industry for governmental research work, was revealed recently by Guy W Vaughan, president of Curtiss-Wright Corp. The new laboratory, where gas-turbine engines can be developed, having in a single unit several times the power of the piston engine now used in the new Lockheed Constellation, is located at the Wood Ridge, N. J. plant of Wright Aeronautical Corp.

The laboratory tests all the major sections that go into a gas-turbine engine. Each basic section of a new engine can be checked without necessity of operating the complete unit. Engineers can study and evaluate each section in greater detail at less cost and more rapidly than was heretofore possible, thus speeding development of the power plant for optimum performance and durability. This is made possible by arranging laboratory in several departments, each concerned with a particular section of the engine. Thus, the behavior of compressors is examined in one section while the ability of turbine blades and combustion chambers to withstand high-operating temperatures is checked simultaneously eleswhere.

In making the announcement, Vaughan said: "The U. S. Army Air Forces has permitted me to reveal that the Wright Aeronautical Corp has in operation a laboratory in which are being tested the largest turbine-type aircraft engines known to be under practical development anywhere in the world. This turbine laboratory is the largest Government research project under private operation in the aviation industry. The Wright turbine laboratory was designed with one specific end in view: to expedite the development of the most advanced engine types of the highest attainable horsepower to bolster America's world air power. Because of the advanced design of this laboratory, both the time and cost involved in preproduction testing, the most serious bottleneck in present production of aircraft power plants, can be reduced substantially.

"The engines now undergoing tests at the turbine laboratory have been under development for three years. Military security does not permit us to reveal the size of these Wright engines. I may say, however, that we confidently expect them to approach the combined power output of four Cyclone-type engines in the Boeing Superfortress and the new-type Lockheed Constellation transport."

More than a score of fuel technicians met with William S Major, development engineer of Bituminous Coal Research, Inc. Pittsburgh, Pa., during the second in a series of "jet clinics" sponsored by the national research agency of bituminous coal industry. Major, assisted by E C Payne, consulting engineer, Pittsburgh Consolidation Coal Co, brought the combustion men up to date on design and installation of BCR-perfected jets as applied to stationary plants.



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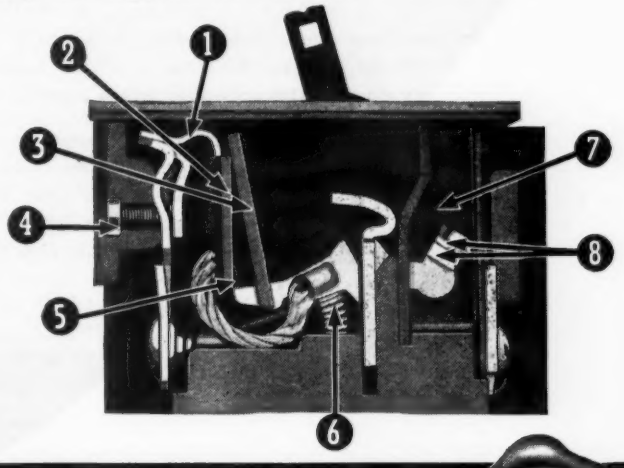

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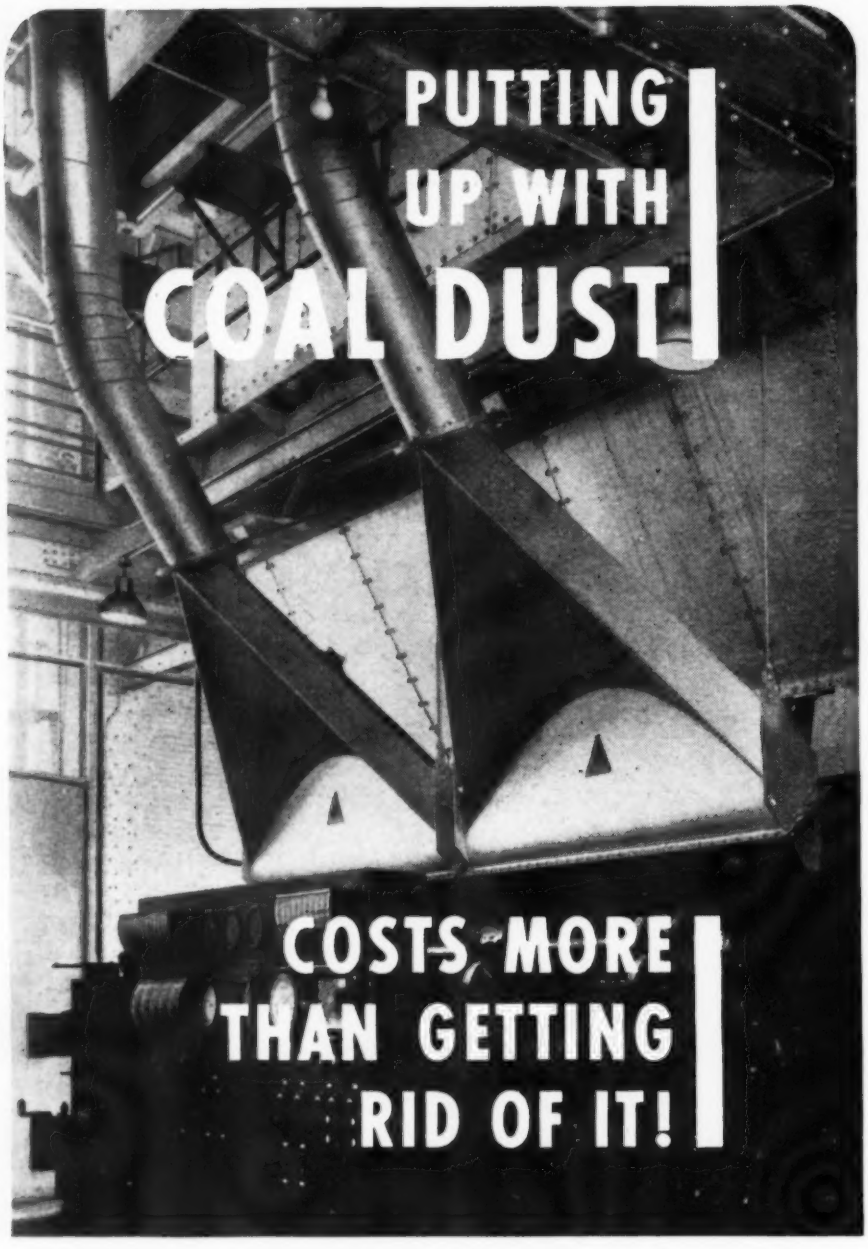

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Smoke Association to Study Stack Emission

The Smoke Prevention Association of America revealed at its 40th annual meeting in Toronto, Ont., the formation of a standardization committee, concerned with measurement of dust and solids emitted by stacks.

J H Carter, commissioner of smoke regulation, St. Louis, Mo., heads up the group, which represents all major manufacturers producing dust-collecting equipment. Prof R R Tucker, former St. Louis smoke commissioner, serves as an advisory member.

A 4-fold project constitutes the work goal of this body. They plan to (1) concentrate on solids, beginning with those resulting from the combustion process, but eventually they will consider all stack-emitted solids (2) decide upon a limit defined in concentration of solids to be applied universally as the allowable stack emission (3) select one unit, as the standard, from the various measurement units (grains per cu ft, pounds per thousand pounds of flue gas, etc) (4) provide an effective standard test method for measuring dust concentrations.

Engineers Joint Council, acting on a request of the State Department, has established a 5-man advisory committee with a 2-fold purpose: (1) to serve as a consultative and advisory group to the Department, as and when requested and (2) to serve the Engineers Joint Council representative, who is to be named shortly, on the U. S. National Commission on UN Educational Scientific Cultural Organization.

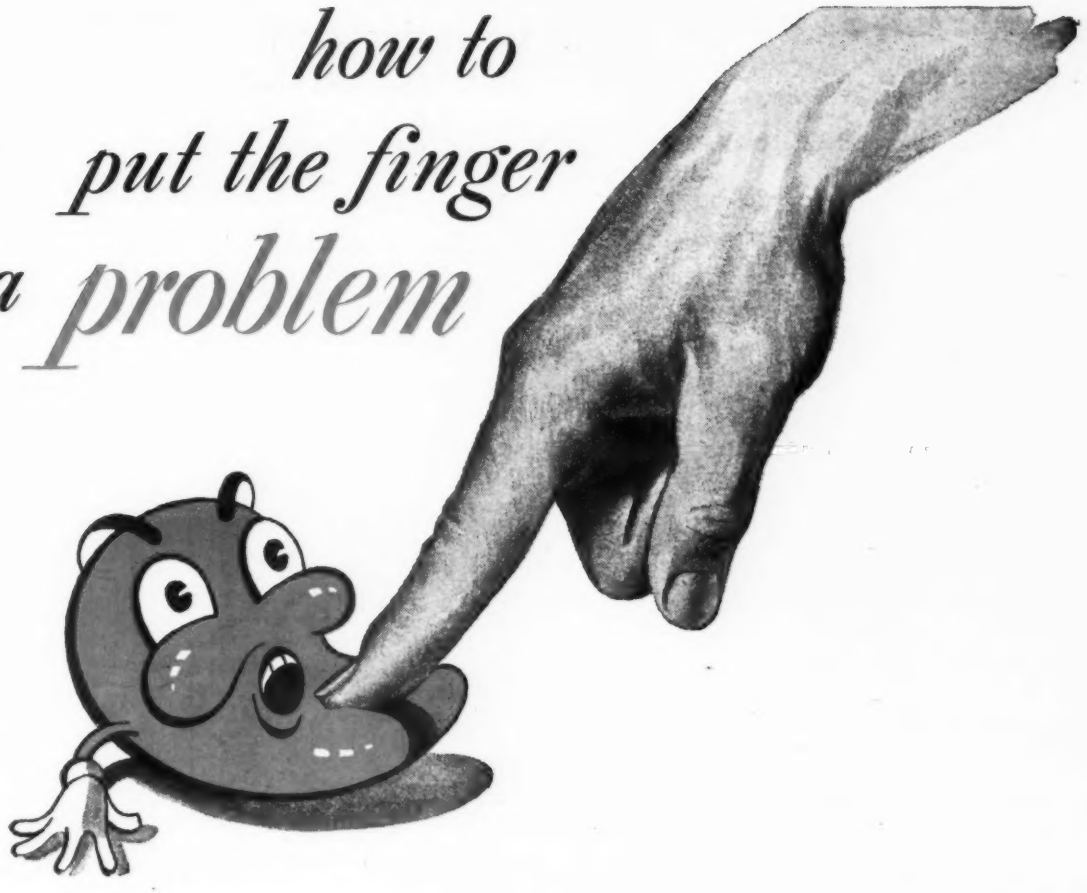
The newly authorized group is called a consultative committee to the committee on international relations of EJC. It is composed of one member of each of the constituent societies of EJC, as follows: (1) E M Hastings, president of American Society of Civil Engineers (2) Clyde Williams, president of American Institute of Mining and Metallurgical Engineers (3) D Robert Yarnall, past president of American Society of Mechanical Engineers (4) W E Wickenden, past president of American Institute of Electrical Engineers (5) J G Vail, past president of American Institute of Chemical Engineers.

Yarnall-Waring Co has issued a celluloid working model that shows sliding plunger principle of *Yarway* blowoff valve. Write to *Yarnall-Waring Co, Chestnut Hill, Philadelphia* 18, *Pa.,* for free copy.

General Electric Co has completed a new plant at Pittsfield, Mass. This plant is equipped to purify, densify and grind crude magnesium oxide. It comprises about 10,000 sq ft and will double GE's capacity to produce magnesium oxide.

Alabama Electric Cooperative, following approval of Rural Electrification Administration, is making plans for early construction of a 23,000-kw steam-electric generating plant at Gantt, near Andalusia, Ala. The plant, which will cost $5,863,100, will serve three Alabama and two Florida cooperatives.

how to put the finger on a problem



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Stoker Manufacturers Push for Standardization

The engineering and Research Committee of the Stoker Manufacturers Association is actively pushing for established standards for its equipment.

In the field of smoke abatement, the committee is working closely with the Coal Producers' Committee for Smoke Abatement and the various cities sponsoring smoke ordinances. It is the aim of the group to have the association's recommendations for stoker equipment become a standard in municipal smoke regulations.

Work is under way to set up a standard procedure for testing and evaluating stoker coal. This project is a joint one with the Residential Stoker Committee of the Bituminous Coal Research.

Studies during the past year have been devoted to fractional-motor standardization. The action of the National Electrical Manufacturers Association to freeze small-motor designs will directly affect every maker of domestic stokers. The association urges all manufacturers to make their requirements known.

New material has been added to the SMA technical manual and that publication is now on the press.

A $29,000,000 expansion of Toledo Edison Co power generation and distribution system in northwest Ohio was announced by Charles E Ide, executive vice-president and general manager of the company. The expansion program, which will begin this year and extend through 1949, is necessary to keep pace with the rapidly increasing domestic, commercial and industrial power needs of the area. Largest single item will be purchase and installation in Acme Plant, East Toledo, of a 90,000-kw turbine-generator which, with the necessary additional plant space and boiler capacity, will cost about $9,500,000. Balance of the expenditure will be for new substations, new transmission lines, and additions and improvements to the transmission grid that serves eight northwestern Ohio counties. Included in the plan are new service centers in the Defiance and Wauseon div headquarters, and addition of substations and transmission facilities in Fremont, Defiance and Wauseon divisions.

Central New York Power Corp has filed with Federal Power Commission a declaration of intention to construct a dam and hydroelectric power plant on West Canada Creek about 14 miles north of Utica, N. Y. Structure would be a concrete gravity dam about 300 ft long with a maximum height of 50 ft. Location has been proposed at a site about two miles downstream from the dam of the Hinckley reservoir, which was constructed by State of New York for a portion of water supply to operate New York State Barge Canal. In the powerhouse, to be constructed with the dam, the company would install two francis turbines with a rated capacity of 9600 hp each and two generators of 8900 kva each. Reservoir, to be formed behind the dam, is expected to cover an area of 168 acres at maximum water level.

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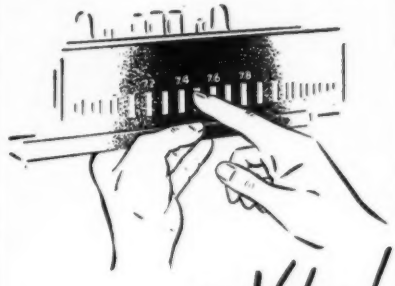

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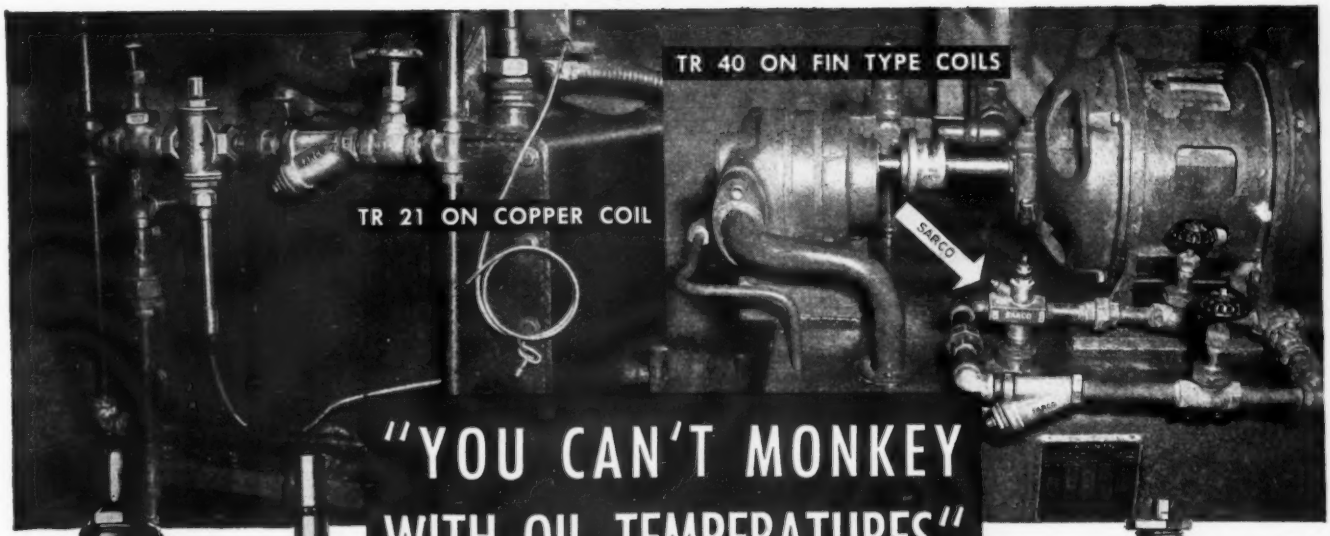

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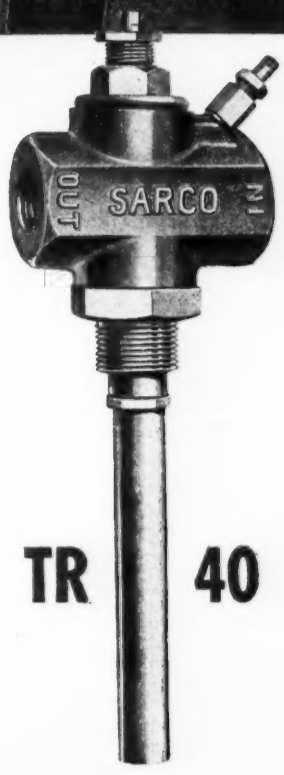

TR 40

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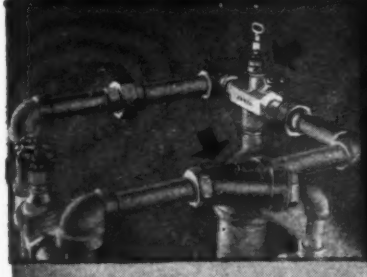
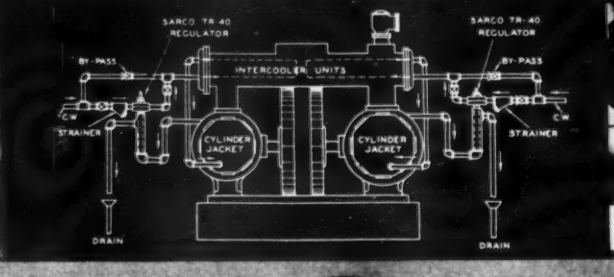
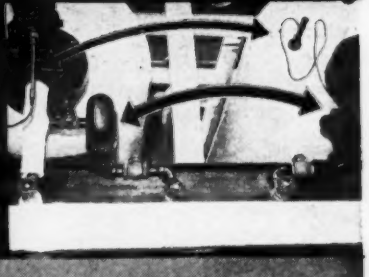
TR 40 ON CONDENSER



TR-40 ON COMPRESSOR



TR 21 ON HOT WATER TANKS



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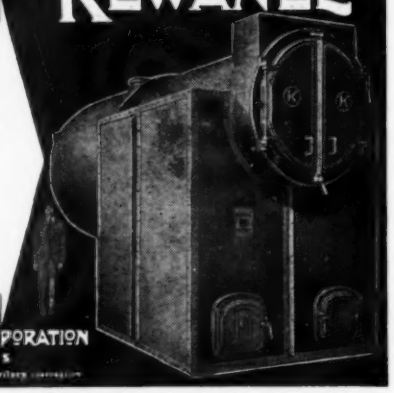

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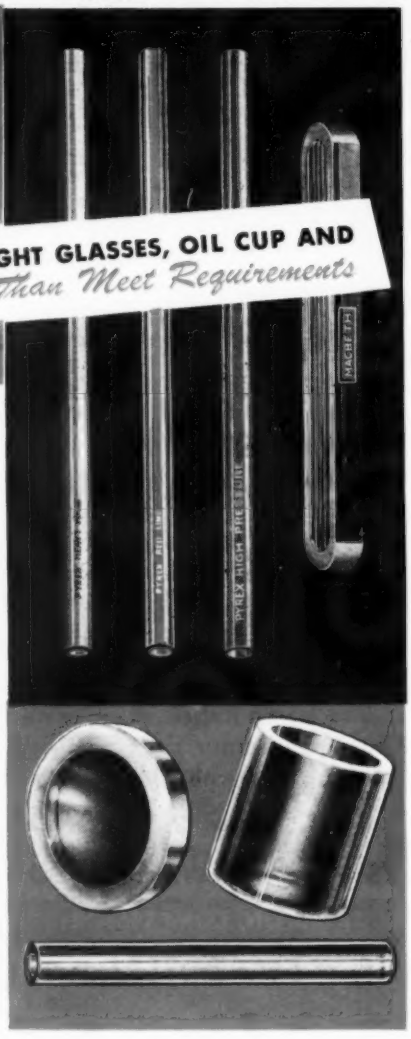

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Pressed by rapidly growing power needs in the Pacific Northwest, Bureau of Reclamation has expanded its plans for Hungry Horse Dam in northwestern Montana to make it the third or fourth highest dam in the world, R J Newell, regional director, announced. The bureau hopes to begin construction of the dam this fall.

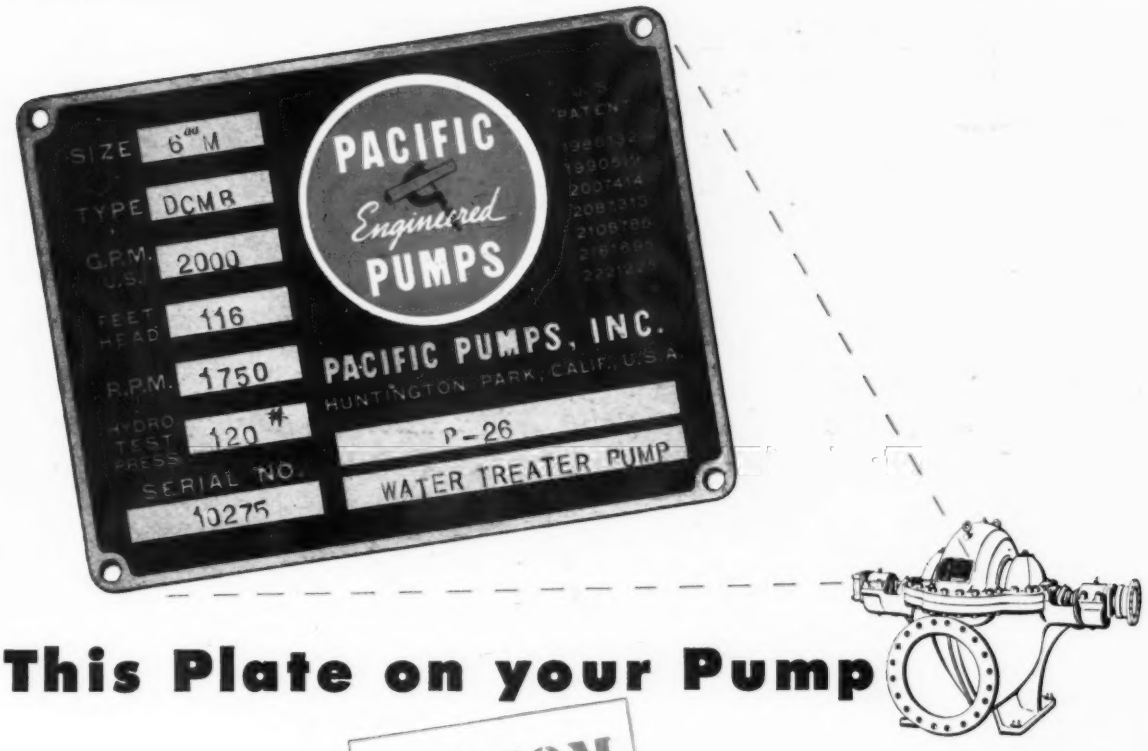
After consultation with Bonneville Power Administration, the bureau has decided to provide a reservoir on south fork of Flathead River that will hold 3,500,000 acre-ft of water instead of the 2,000,000 acre-ft, or less, originally planned. The anticipated installed capacity of the power plant to be erected at the dam will be 286,000 kw. Water storage of 3,500,000 acre-ft will increase by some 334,000 kw the firm power capacities of existing downstream power plants at Kerr Dam and Thompson Falls, Mont., and at Grand Coulee, Rock Island and Bonneville Dams on the main Columbia River. It would add 477,000 kw to the firm power capacities of power plants likely to be installed downstream as part of the ultimate development of the river system.

A concrete dam about 535 ft high or higher will be required by the new plans. The final height cannot be determined until exploration of bedrock and final designs for the structure have been completed.

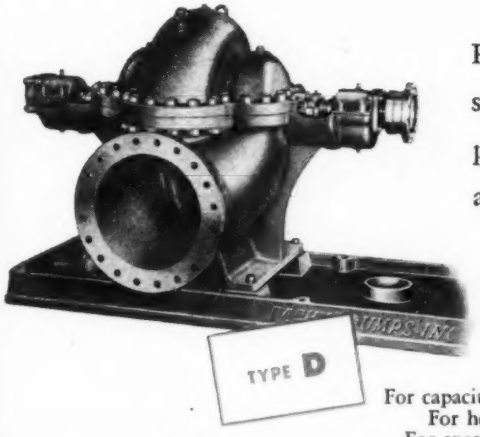
Los Angeles Board of Water and Power Commissioners has authorized immediate development of the hydroelectric power resources along the Owens River Gorge at a total cost of $40,500,000. Three power plants will be built in the project, one below the other, each containing a single turbine-generator of 37,500-kw capacity, to utilize a 2375-ft drop from Crowley Lake to the end of the gorge near Bircham's Canyon. A 250-mi 230,000-v transmission line will be constructed from the gorge to a receiving station in San Fernando Valley. The department anticipates that peak demand plus a necessary spinning reserve will reach 1,020,000 kw by 1950. Present generating capacity of its system, including new facilities now under construction at Harbor steam plant in Wilmington, totals 990,000 kw. With the Owens Gorge facilities, capacity will reach 1,100,000 kw.

Ground was broken recently for the first major building in the extensive Carborundum Co building program, which will eventually involve an expenditure of over fifteen million dollars. The structure will be known as the maintenance building; its estimated cost, including equipment, will be over a million and a quarter dollars. New structure will provide 120,000 sq ft of operating space, over twice that in the present maintenance building. It will house all maintenance groups and have offices for a central maintenance-planning group, maintenance engineering and supervision. The building will be ready for occupancy by some 500 maintenance dept employes on or about Jan 1.

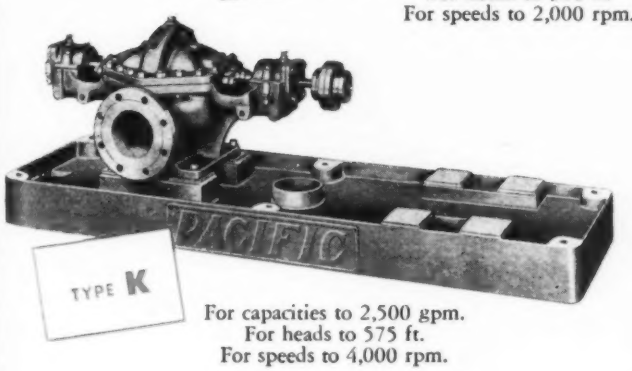
Manhattan Rubber Div, Raybestos-Manhattan, Inc, Passaic, N. J., has again received the Award of Excellence for its business-paper advertising campaign from the National Advertising Agency Network at the fourteenth annual competition, held recently at French Lick, Ind.



This Plate on your Pump means CUSTOM BUILT for your Service



For capacities to 20,000 gpm.
For heads to 300 ft.
For speeds to 2,000 rpm.



For capacities to 2,500 gpm.
For heads to 575 ft.
For speeds to 4,000 rpm.

Pacific Pumps are not stock pumps . . . They are built to meet your specific service condition. Hydraulically correct, perfectly balanced dynamically, precision finished in every detail . . . These factors assure you efficiency and economy on every type of Pacific Pumping installation.

Shown at the left are two types of single stage, double suction volute centrifugal pumps for industrial and domestic water supply, circulating water, booster service, etc. Pacific Pumps are custom-built for any of these services. Write today, specifying your requirements.

PACIFIC
Precision Built
PUMPS

PACIFIC PUMPS INC. HUNTINGTON PARK, CALIFORNIA
One of the Dresser Industries
Mid-Continent Division: 915 E. Second St., Tulsa, Oklahoma
Export Office: 122 E. 42nd St., New York City
Offices in All Principal Cities

PUT STEAM
FULLY TO WORK

...By-Product Power

THE ENGINE PAYS
FOR ITSELF AFTER A
FEW MONTHS ON THE JOB!

If you use steam for heating or processing you can probably cut power costs by installing a Troy-Engberg Steam Engine and using By-Product Power to drive stokers, generators, compressors, pumps or blowers.

With proper plant heat balance you use steam direct from the boiler to run the engine and THEN introduce the exhaust into your processing or heating. The engine acts as a reducing valve, producing POWER at the same time. It's By-Product Power. It's exceptionally cheap power.

Consult our engineers about saving with By-Product Power.

TROY ENGINE & MACHINE COMPANY
Established 1870
2500 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
AM ENGINES • GENERATING SETS • GENERATOR

McGRAW-HILL *World News*

ROME: Italy's desperate coal shortage—the chief reason why Italian industry stays throttled down to about half of prewar output—has led the Italian electric companies to join with the Ministry of Public Works in drawing up a large-scale plan for expanding the country's hydro-power facilities. This plan follows the major reconstruction that has been accomplished in restoring existent war-damaged facilities.

The plan, regarded as a minimum program, calls for expenditure of about 600 billion lire ($1.2 billion) over the next ten years on new generating plants, substations and transmission lines. This would add nearly 80% to the 6,230,000-kw capacity of all Italy's generating stations in 1941. The new 4,920,000 kw of capacity is slated to produce 12.5 billion kwhr annually. Of the total expenses, 400 billion lire ($800 million) is slated for generating plants, 50 million lire ($100 million) for substations and 150 billion lire ($300 million) for transmission lines.

It is, of course, uncertain whether Italy and her private electrical companies will be able to afford the equipment and materials necessary to execute such a grand-scale program.

INDIA: The Central Government will take up shortly preparation of a multipurpose river-control project on the Narbada and Tapti Rivers in Northern Bombay Province. Preliminary estimates indicate that a system of dams across the two streams, which do immense damage in the monsoon season, might ultimately permit irrigation of farm land up to one million acres in the Surat and Broach Districts, and provide generation capacity up to one million kw. Maximum discharge of the Tapti is about 100,000 cusecs—about that of the Tennessee River—while the Narbada is between 150 and 250% of that figure.

LUCKNOW, INDIA: United Provinces provincial government has laid out a program for construction of six hydroelectric projects with a combined capacity of 300,000 kw which, when completed, will save the provinces roughly $6,000,000 now spent on coal.

Construction is already under way on a 9300-kw plant on the Ganges Canal at Mohammadpur and on a 41,000-kw plant on Sarda River near Banbassa. Meanwhile surveys have been completed for a 40,000-kw station at the Nayar Dam to supplement the Ganges Grid, the 50,000-kw Jumna project on the Tons River in the western section of the province, the 130,000-kw Rihand Dam project in Mirzapur district in eastern section, and the 30,000-kw Betwa River project in Jhanso district. Ultimate plans call for the hookup of all provincial stations in one grid.

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Reader Service Page for . . .

NEW EQUIPMENT and TECHNICAL LITERATURE

Use these handy FREE service cards for additional information on this month's new products or for copies of latest trade literature.

NEW PRODUCTS & MATERIALS

See pages 130-134, 164-178

Air-Cooled Transformer.....page 130
Voltage Regulator.....page 130
Improved Gas-Diesel.....page 130
Clamp Supports.....page 130
Outlet Box.....page 130
Panel Meter.....page 130
Test Cabinet.....page 132
Water-Level Controller.....page 132
Welding Flux.....page 132
Automatic Burette.....page 132
Cooling Tower.....page 132
Pipe Fittings.....page 132
Strainer.....page 132
Check Valve.....page 132
pH Meter.....page 132
Pressure-Test Unit.....page 134
Positioning Control.....page 134
Oil-Resistant Insulation.....page 134
Arm Welder.....page 134
Magnetic Pulley.....page 134
Arc Torch.....page 134
Fluid Power Transmissions.....page 134
Pipeline Strainer.....page 164
Electric Contacts.....page 164
Insulated Splice.....page 166
Multiple Oiler.....page 166
pH Meter.....page 168
Lubricating Cart.....page 168
Filling Connector.....page 170
Air-Operated Humidifier.....page 170
Time-Cycle Controller.....page 172
Pump Governor.....page 172
Flight Conveyor.....page 176
Disconnect Reflector.....page 176
Belt-Conveyor Takeup.....page 178
Feeder Bus.....page 178

MANUFACTUERS' BULLETINS

See pages 190b-198

Boilers and Auxiliaries.....page 190b
Controls, Mechanical.....page 190b
Electrical Equipment.....page 190b
Maintenance and Safety Equipment.....page 190b
Maintenance Materials.....page 192
Mechanical Transmission.....page 192
Metals and Alloys.....page 192
Meters and Instruments, Mechanical.....page 194
Piping, Fittings, Valves and Specialties.....page 194
Prime Movers and Accessories.....page 194
Pumps.....page 196
Welding.....page 196
Other Equipment.....page 198

(Turn over for bulletin items)

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

Write here number of item in which you are interested → E17

Your Company Name: Brown Mfg. Co.

Address: 3718 First Avenue, Pottsville, Okla.

Your Name: John Smith

Your Title: Power Engineer

POWER, 330 West 42nd St., New York 18, N. Y.

FILL OUT AND MAIL TODAY! NOT GOOD AFTER DEC. 1, 1947

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Your Name.....

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BOILERS AND AUXILIARIES

1 **STEAM-GENERATING UNITS**—Orr & Sembower, Inc, Morgantown Rd, Reading, Pa. 8-page bulletin No. 1215 describes Powermaster automatic steam-generating units for light-oil and heavy-oil operation. A cutaway view shows Powermaster's inside construction design.

2 **OIL BURNER**—Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y. Bulletin discusses construction, application and advantages of "Wide Range" Y-jet steam atomizing oil burner.

3 **HEATING SURFACE**—Crotty Mfg Corp, 133-15 35th Ave, Flushing, L. I., N. Y. 8-page booklet presents Crotty waterwall furnace and boiler amplifier, which eliminates excavation.

4 **TUBULAR AIR HEATER**—Babcock & Wilcox Co, 85 Liberty St., New York 6, N. Y. 16-page bulletin, entitled "B & W Air Heaters," discusses economic and engineering factors involved in selection of air heaters and illustrates various types of B & W construction that are available.

5 **SMOKE PREVENTION**—Industrial controls div. Perfex Corp, 500 W Oklahoma Ave., Milwaukee 7, Wis. 16-page booklet shows causes and cost of smoke and how it can be prevented.

6 **OIL-BURNER FILTERS** — Cuno Engrg Corp, Meriden, Conn. 8-page bulletin No. MK 3217 gives advantages of Micro-Klean filters. Photos, diagrams and tables are included.

7 **SMALL BOILER**—Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y. Bulletin describes Type H Stirling boiler, a relatively small, water-tube unit for installation where headroom is limited.

8 **STEEL BOILER**—Kewanee Boiler Corp, Kewanee, Ill. 4-page catalog No. 88-4 presents Square Heat Type R boiler for heating medium-sized buildings. Photos, diagrams and tables are given.

9 **AUTOMATIC BOILERS**—Steamaster Automatic Boiler Co, S Compton Ave & Slauson Blvd, Los Angeles 11, Calif. 4-page booklet gives advantages of Steamaster automatic boilers.

10 **STEEL BOILER**—Kewanee Boiler Corp, Kewanee, Ill. 8-page catalog No. 97 covers Kewanee Type C steel boiler for heating large buildings. Photos and diagrams show construction.

11 **STEAM DRYERS**—Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y. Bulletin, entitled "Steam Separation," describes B & W's equipment for steam separation in boiler drums, B & W steam scrubbers and Cyclone steam separators.

CONTROLS, MECHANICAL

12 **AUTOMATIC CONTROLS**—Askania Regulator Co, 240 E Ontario St, Chicago 11, Ill. 16-page bulletin No. 135 describes various control systems for controlling stack draft, furnace pressure and collector mains in gas producing plants. Booster and exhauster controls, for single or parallel operation, are explained.

13 **COMBUSTION CONTROL**—Hays Corp, Michigan City, Ind. 12-page condensed catalog No. 47-687 covers Hays line of combustion and industrial instruments and controls. Photos and diagrams are included.

14 **FLOW REGULATOR** — Northern Equipment Co, Erie, Pa. 12-page bulletin No. 429B presents Copes Flowmatic regulator for boiler water-level control. Photos, charts and diagrams are shown. A list of users is included.

ELECTRICAL EQUIPMENT

15 **SQUIRREL-CAGE INDUCTION MOTOR**—Electric Machinery Mfg Co, Minneapolis 13, Minn. Large colored fold-out sheet 4695, suitable for wall hanging, has detailed cutaway drawing of new 2-pole 3600-rpm squirrel-cage induction motor.

16 **CURRENT LIMITER** — Burndy Engrg Co, 107 Bruckner Blvd, New York 54, N. Y., Bulletin 46Z3 covers high-capacity limiters for industrial network systems up to 600 v. Many graphs and oscillograms are given, showing performance characteristics of Limiters.

17 **VOLTAGE EQUIPMENT**—Superior Electric Co, Bristol, Conn. 12-page bulletin No. 150 discusses variable-voltage transformers, automatic-voltage regulators and test instruments.

18 **ELECTRONICS** — Minneapolis-Honeywell Regulator Co, Minneapolis 8, Minn. 8-page booklet tells about science of electronics in simple language. Booklet is designed to serve as an introduction to our electronic age.

19 **INSTRUMENT PANELS** — Falstrom Co., Falstrom Ct, Passaic, N. J. 8-page bulletin presents Falstrom instrument panels and cubicles. Instructions for ordering standard panels are given. Photographs and diagrams of equipment are included.

20 **VOLTAGE EQUIPMENT**—Superior Electric Co, Bristol, Conn. 12-page bulletin No. 547 features latest developments in Powerstat variable transformers and Stabiline voltage regulators.

MAINTENANCE AND SAFETY EQUIPMENT

21 **STEAM-CLEANING UNIT**—Oakite Products, Inc, 22 Thames St, New York 6, N. Y. 12-page booklet describes the new improved Oakite-Vapor steam-cleaning unit. Data on unit construction, engineering specifications, types of models available and job applications are given.

22 **WELDING ROD HOLDER**—Tweco Products Co, Wichita 1, Kan. 12-page 1946 Twecolog catalog and single-sheet Form KD-316 present the Twecotong welding rod holder, Tweco Hol-Grip holders, carbon electrode holders, Redhead ground clamps, cable connectors, machine terminals, mechanical cable lugs, cable splicers, etc.

23 **CARBON BRUSHES**—Helwig Co, 2544 N 30th St, Milwaukee 10, Wis. 4-page bulletin MT features Transert brushes, designed for use under bad atmospheric conditions, and Multiflex brushes, designed for multiple brush operation without expensive changes.

24 **TUBE FABRICATING EQUIPMENT**—Parker Appliance Co, 17325 Euclid Ave, Cleveland 12, Ohio. Tube fabricating equipment catalog No. 401 describes Parker production tube bender and accessories, hand benders, cutters, flaring tools, beading kit and tube fabricating service.

25 **PLIERS AND WRENCHES**—Plomb Tool Co, 2209B Santa Fe Ave, Los Angeles 54, Calif. Bulletin No. 4728 gives descriptive data on 24 pliers, 12 adjustable wrenches and six pipe wrenches.

(*Continud on page* 192)

FIRST CLASS
PERMIT No. 64
(Sec. 510, P.L. & R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

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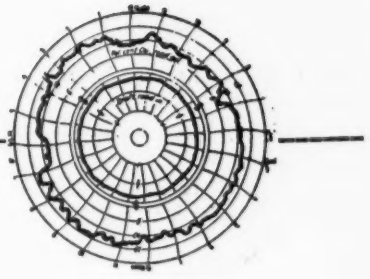
UNIFORM COAL SIZING REDUCES...

RAGGED FIRING

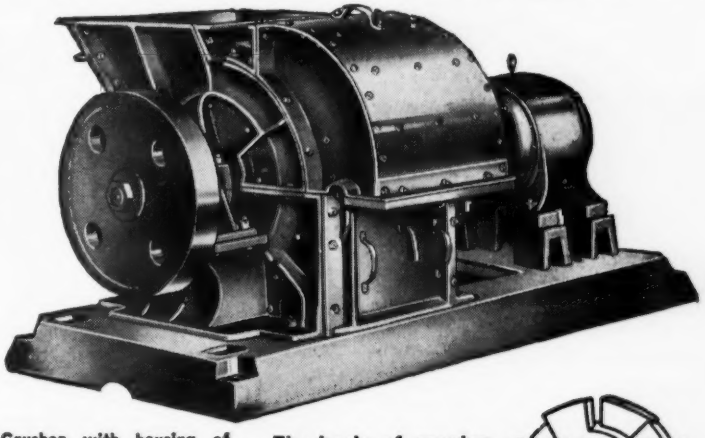
EXCESSIVE CO_2

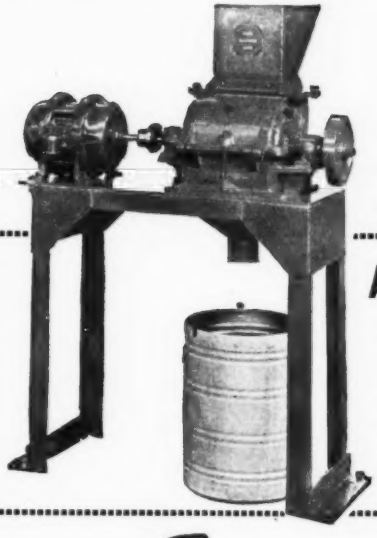
ASHPIT LOSS



AMERICAN Rolling Ring CRUSHERS give High Tonnage and Uniform Sizing with Minimum Fines and No Oversize

Ragged firing—with alternately excess air and insufficient air . . . excessive CO_2 instead of uniform combustion . . . excess ash pit drops—are all costly and inefficient results of coal not uniformly sized. ROM coal, even poor grades, is uniformly reduced by Americans for improved firing efficiency. Control of fines and no oversize provide for uniform, high combustion.





American Type "S" Crusher with housing of massive, high test cast construction — rib reinforced to withstand enormous crushing strains. Dust-tight machined joints. Self-aligning anti-friction bearings in dust-tight pillow blocks.

AMERICAN Laboratory Mills

AMERICAN Laboratory Mills are custom-built to provide the required action for your specific laboratory or pilot plant operation. Rolling rings, shredder rings or hammers of regular or special types can be furnished to provide the exact type of reduction needed. In addition, AMERICAN Laboratory Mills reduce grog for use in firebox liner replacement.

The basis of greater crushing efficiency is the manganese shredder rings — exclusive with Americans. Because shredder rings split coal at low, power saving speeds instead of crushing it at high speeds—fines are controlled. Each ring revolves on an individual shaft—free to deflect without damage from tramp iron—eliminating the necessity for shear pins or conventional safety devices.

Send for bulletin: "Crushing Coal for Less Than 1¢ a Ton"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

WHAT'S THE DIFFERENCE?

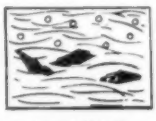
Outwardly, none. Friends easily can tell identical twins apart because they know the *hidden differences.*

In water there are *hidden differences* too. K.A.T. was developed to meet this condition in your boiler. Since All-Colloidal K.A.T functions by physical action — not chemical reaction — it is effective against all impurities in any water regardless of composition.

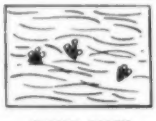
ALL COLLOIDAL K.A.T.* WATER TREATMENT

Employed as a complete or "finishing" treatment, user records show that K.A.T. improves boiler efficiency • Removes and prevents scale accumulation • Inhibits corrosion • Safeguards steam purity • Lowers fuel, labor maintenance costs • Permits almost continuous boiler operation.

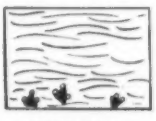
K.A.T.



FIRST STAGE



SECOND STAGE



THIRD STAGE

It will pay you to test K.A.T. in your own plant today.

Literature on Request
Representatives in principal cities

* T. M. Reg. U. S. Pat. Off.

AMERICAN K.A.T. CORPORATION
331 Madison Ave. New York 17, N. Y.

Gentlemen:
Please send me free descriptive literature on K.A.T.
Name.....
Company.....
Address.....
City..... State.....

26 **ROTARY FILES**—Grobet File Co of America, 421 Canal St, New York, N. Y. 16-page booklet lists the different Grobet rotary files. These include ball, oval, cylindrical tree, cone, inverted cone and other shapes, each in a wide range of diameters and lengths of cut.

27 **STEAM-CLEANING MACHINE** — White Engrg & Mfg Co, 157 W Passaic St, Rochelle Park, N. J. 4-page folder presents the new model MO-46B White-Ofeldt vapor steam cleaner. Special features, specifications and accessories are given.

MAINTENANCE MATERIALS

28 **DEGREASERS AND SAFETY SOLVENTS**—Gaybex Corp, 70 Lister Ave, Newark 5, N. J. 4-page bulletin No. A-10 gives descriptions of the company's entire line of degreasers, safety solvents, detergents and penetrants.

29 **MAINTENANCE PRODUCTS** — Stonhard Co, 403 Broad St, Philadelphia 8, Pa. 48-page catalog, entitled "Over the Rough Spots," describes Stonhard materials for floors, walls and roofs. The Stonhard line includes acidproof coating, foundation coating, Bondite, Concretite, dustproofer and concrete filler, resurfacer paint, etc.

30 **SOOT AND SLUDGE REMOVER**—Elraco Engrg Co, 732 W 58th St, Los Angeles 44, Calif. 4-page bulletin No. E-57 presents Elraco soot and sludge remover, a liquid fuel-oil treatment.

31 **FLOOR REPAIR**—Stonhard Co, 403 N Broad St, Philadelphia 8, Pa. Folder tells how to make floor repairs with Stonhard Stonfast. Folder also describes how Stonfast is used.

32 **BUILDING MAINTENANCE** — Continental Asbestos & Refining Corp, 1 Madison Ave, New York 10, N. Y. 32-page catalog outlines specific maintenance problems and explains how each product may best be used to solve these problems. There are four sections: (1) products that will preserve and improve floors (2) protective and decorative coatings for interiors and exteriors of buildings (3) heat system, water system and metal conditioners (4) cleansers and disinfectants.

MECHANICAL TRANSMISSION

33 **CONVEYOR BELTS**—B F Goodrich Co, Akron, Ohio. 4-page catalog section No. 2220 covers line of conveyor belts. This section gives details of each brand and special constructions available in various belts, as well as a list of applications.

34 **MAGNETIC CLUTCHES**—Stearns Magnetic Mfg Co, Milwaukee 4, Wis. 20-page catalog No 226 discusses magnetic clutch application and contains specifications, illustrations, torque formulae and other data on magnetic friction device control.

35 **VARIABLE SPEEDS** — American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa. Speed-Jack drives bulletin features drive tables and charts that enable users to quickly select proper size sheaves for desired range of speed. Also, bulletin shows construction details and suggested applications.

36 **SMALL TRANSMISSIONS** — Oilgear Co, 1384 W Bruce St, Milwaukee 4, Wis. 8-page bulletin No. 67110 describes line of small fluid-power variable-speed transmissions up to 3 hp.

37 **TRANSMISSION BELTS**—B F Goodrich Co, Akron, Ohio. 12-page catalog section 2150, entitled "Selection and Maintenance of Rubber Transmission Belts," provides a guide to the application and care of flat rubber belting.

METALS AND ALLOYS

38 **COPPER AND COPPER ALLOYS** —General Offices, American Brass Co, Waterbury 88, Conn. 28-page booklet B-34, entitled "Copper and Copper Alloy Specifications Index," is in two sections. The first part lists the company's most generally used alloys together with the applicable specifications. Section 2 lists specifications in numerical order with a brief description of the material as to the grade, type, temper, anneal, etc.

PEERLESS PUMPS

Peerless Pumps add a "plus" TO DEEP WELL PUMP PERFORMANCE

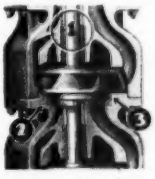
Peerless Pumps offer the widest range of water capacities from 15 to 30,000 gallons per minute from all depths

Peerless Pioneered in the development of water from wells of great depth.

Available in water or oil lubricated types. Pre-tested to meet exact conditions of well and application.

Top-Flight Quality Underground From Patented Double Bearing—Double Seal Bowl Construction

Double Bearings (1) one bronze and one Goodrich Cutless Fluted Rubber bearing for each pump bowl add double life to bearings and impeller shaft. Double Seal (2) mounted below impeller neck (3), is a durable, resilient ring — automatically compensating for wear.



Peerless Turbine design permits wide adaptability to diversified applications

Peerless turbine pumps are also available in close-coupled types for pumping from shallow pits, sumps, or surface water sources. With proper fittings Peerless Turbine Pumps are Underwriters' approved for adequate independent plant fire protection. Request Bulletins.

PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION

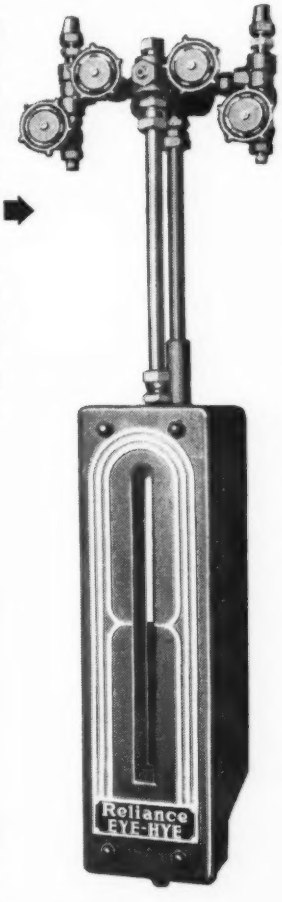
Factories: Indianapolis, Ind. Los Angeles 31, Calif. Quincy, Ill.
District Offices: Canton 2, Ohio; Philadelphia: Suburban Square, Ardmore, Pa; Atlanta: Rutland Bldg., Decatur, Ga.; Dallas 1, Tex.; Los Angeles 31, Calif.

It takes *Team Work* to prevent boiler accidents

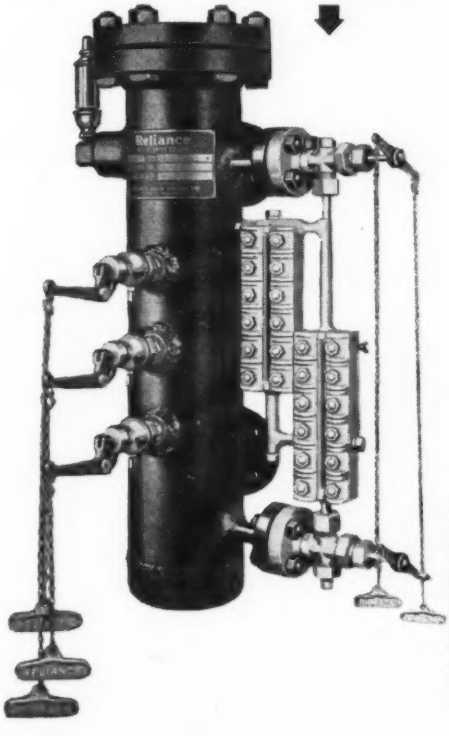
Reliance Safety Team

helps you to achieve efficient power production free from costly shut-downs due to water-level failure . . .

Reliance EYE-HYE Remote Reading Indicator. Reading accurately at eye height at a prominent convenient point—perhaps right alongside instruments on your panel—EYE-HYE provides a sharply visible sight check denying any argument that water gages are "hard to see."



Reliance Alarm Water Column. This faithful sentinel at the boiler drum responds to less than a quarter inch change in the water level—sounds its shrill whistle when the level approaches points too low or too high for safety.



YOUR casualty insurance man will tell you that boiler accidents still happen—far too many of them—in spite of modern controls and instruments. Extra *preventive* insurance—the Reliance Safety Team—that will serve you faithfully for many years, can be had for very small cost compared to the major equipment it protects.

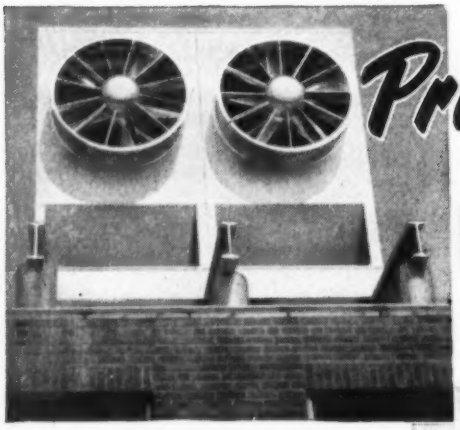
No amount of *equipment* entirely offsets factors such as ignorance, carelessness and indifference on the part of operators. It takes *teamwork* between men and devices to prevent the accidents that kill or injure employees, damage property, and cause large losses through plant shut-downs. That is your management problem. But if your men can *hear* and *see,* their attention to the water level information supplied by the Reliance Safety Team will prevent boiler water level accidents.

Safe efficient water level supervision is achieved in thousands of power plants with the help of Reliance Boiler Safety Devices—made by the oldest exclusive manufacturer of boiler water columns and gage equipment. Ask your nearest Reliance Representative, or write to the factory.

BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. · 5902 CARNEGIE AVENUE · CLEVELAND 3, OHIO



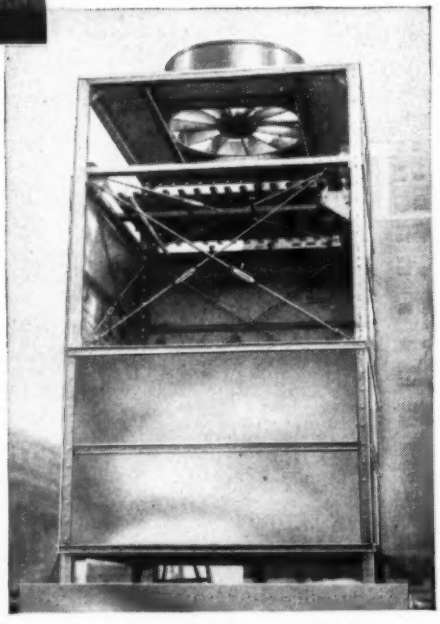
Pritchard

Small and Medium Capacity COOLING TOWERS

Shipped from Stock!

INDUCED DRAFT either horizontal or vertical air flow, with the outstandingly efficient Moore "Lifetime" Fans

. . . the All-Monel fan with permanently lubricated direct drive motor built right into the hub



These All-Monel Fans provide the first fully satisfactory solution to operating difficulties which have vexed owners of mechanical draft cooling towers for years.

No gears, no belts, no coupling, no corrosion problems. Maintenance is nil! These ruggedly constructed, cooling tower, pressure blowers are service-proved for trouble-free, high-efficiency, heavy-duty performance under severest operating conditions.

The slow-speed, ball bearing motor is cased in the hub and suspended in the fan ring by hollow vanes. These vanes guide the air stream and also permit fresh air to enter to ventilate. the lifelong lubricated motor.

Other advanced and thoroughly proven Pritchard mechanical and structural features throughout the tower.

Also NATURAL DRAFT TOWERS . . .

available in a complete range of capacities for roof or ground installation as standard spray towers, or with coil systems in base for closed system cooling. Offered with or without basins or internal decks. Low pressure water distribution system minimizes pumping cost. Slip-fit louvers lift out easily for access to interior. Simple bolted assembly of Redwood or All-Metal shipped complete, knocked down. No special knowledge, special tools or skilled labor required to install.

Also all other types and sizes; 20 years of Cooling Tower Leadership.

For further information see Sweet's Files, Chemical Engineering Catalog, ASH & VE Guide, etc., or phone or write your nearest Pritchard office.

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS • MANUFACTURERS

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New York · Chicago · Houston · St. Louis · Tulsa · Pittsburgh · Dallas · Detroit
Denver · Atlanta · St. Paul · Salt Lake City · El Paso · Erie · Little Rock · Richmond

39 **CORROSION-RESISTING ALLOYS** —Duriron Co, Dayton 1, Ohio. 4-page bulletin No. M-5, entitled "Is There Poison In Your Corrosion Resisting Alloy?" debunks poison danger from corrosion-resisting alloys. It gives reasons why Durimet should be chosen as an alloy for corrosion-resisting equipment.

40 **STAINLESS METAL** — Platework div, Dominion Bridge Co, Ltd, Box 280, Montreal, Que., Canada. 32-page booklet shows some typical examples of platework fabrication for the principal industries.

METERS AND INSTRUMENTS, MECHANICAL

41 **THERMOMETERS AND GAGES**—Bristol Co, Waterbury 91, Conn. 16-page bulletin No. T835 covers line of Series 500 recording thermometers and gages. Bulletin gives detailed information in form of descriptions and pictures of the new instruments.

42 **OIL TEST SET**—Roberts-Konrad, Inc, 90 West St, New York 6, N. Y. 4-page folder describes Rokon oil test set, a compact field kit containing all equipment necessary to determine flash point, viscosity and gravity of lubricating and fuel oils.

43 **PRESSURE INDICATOR**—CookCo Engrg Co, 1737 Howard Ave, Chicago 26, Ill. Leaflet No. 603c presents Ball-Check indicator for testing diesel cylinder pressures. Leaflet gives construction and operation.

44 **OXYGEN RECORDER** — Hays Corp, Michigan City, Ind. 8-page advance bulletin No. 47-844 discusses Hays Magno-Therm electronic oxygen recorder.

PIPING, FITTINGS, VALVES AND SPECIALTIES

45 **VALVES AND FITTINGS**—Alloy Steel Products Co, Linden, N. J. 54-page catalog No. 47 covers Aloyco line of stainless-steel valves and fittings. Design and construction details are given.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **EXPANSION JOINTS** — Zallea Brothers & Johnson, 814 Locust St, Wilmington 99, Del. 60-page catalog No. 47 discusses various kinds of expansion joints and connectors.

46 **PIPE FITTINGS**—Northern Indiana Brass Co, Elkhart, Ind. Catalog No. 901 covers Nibcoloy stainless-steel and nickel-alloy fittings. Roughing-in dimensions and prices are listed.

47 **STEAM JETS**—Duriron Co, Dayton 1, Ohio. 8-page bulletin No. 1804 gives a complete description of Durco corrosion-resistant steam jets.

48 **INVERTED-BUCKET FLOATS** — Armstrong Machine Works, Three Rivers, Mich. 4-page bulletin No. 178 describes Armstrong inverted-bucket high-side floats for discharging liquid refrigerant to low side of refrigerating systems.

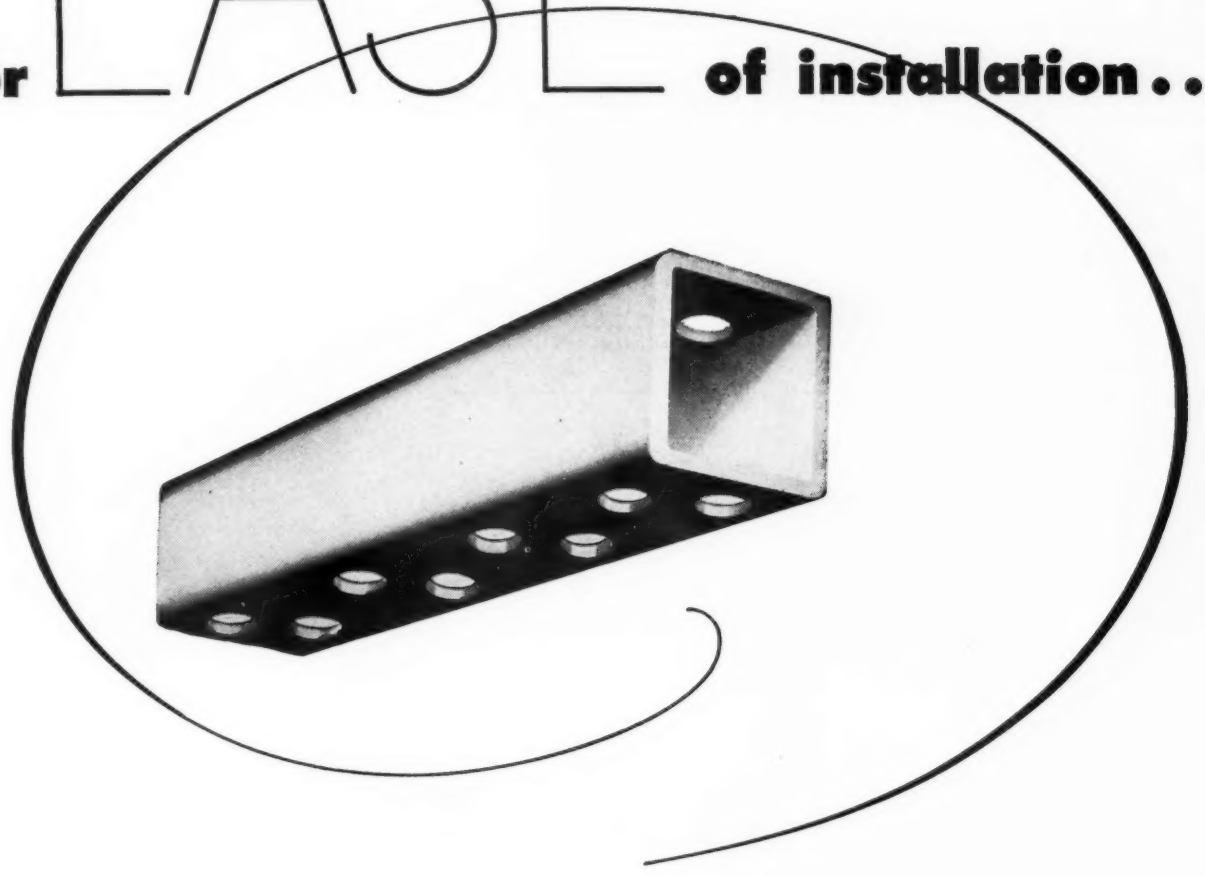
49 **WELDING FITTINGS** — Midwest Piping & Supply Co, 1450 S 2nd St, St. Louis 4, Mo. 8-page bulletin No. 47-1 lists sizes, dimensions, diameters, weight, list prices, etc, of Midwest stainless-steel welding fittings. Bulletin also gives suggestions for welding of stainless steels.

50 **LIQUID FILTER**—Stearns Magnetic Mfg Co, Milwaukee 4, Mo. Bulletin No. 120B presents Stearn's magnetic screen filter separator for any problem requiring removal of iron or steel particles from liquids.

PRIME MOVERS AND ACCESSORIES

51 **DIESEL AUXILIARIES**—Diamond Chain Co, Indianapolis 7, Ind. 12-page booklet, entitled "Diamond Diesel Drive Dozen," describes roller chain engin drives, including a series of examples of timing, pump, generator, blower exciter and other auxiliary drives.

For EASE of installation...



CHASE one-piece bus conductor

NO auxiliary clamping devices are needed for this Chase Copper Bus Conductor. The square one-piece copper tube, first developed commercially by Chase, is neat, simple and economical. Rigid, one-piece construction makes it exceptionally easy to mount, saving installation time and labor.

But Chase engineering ingenuity didn't stop with improved *design*. On the performance side, you get such *plus* features as high current-carrying capacity and great mechanical strength in all directions.

Consider Chase Square Tube before you undertake any new AC bus installations. The Chase Electrical Handbook has complete information on this and other Chase Bus Conductor forms. For complimentary copy, write (on company letterhead) to Dept. PO-97.

Chase *the Nation's Headquarters for* **BRASS & COPPER**

WATERBURY 91, CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS† NEW YORK PHILADELPHIA PITTSBURGH† PROVIDENCE† ROCHESTER† SAN FRANCISCO SEATTLE† ST. LOUIS WASHINGTON† (†Indicates Sales Office Only)

Save Time, Material and Labor . . . . .
by cutting gaskets the modern way

ALLPAX

GASKET CUTTER

Savings of 25% in material and a tremendous saving in time and labor are being recorded every day where ALLPAX Gasket Cutters are being used. Here is an inexpensive tool that is paying for itself over and over again in plants and shops in all parts of the country. Users are enthusiastic with the way the ALLPAX cuts gaskets in any gasket material faster, and cleaner, than could ever be done by old-fashioned hand methods.

Furnished complete, ready for use, in hardwood case, for cutting gaskets from 1" to 36". Price $19.50 f.o.b. Mamaroneck, N. Y.

30-DAY FREE TRIAL OFFER

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THE ALLPAX CO., INC., *Mamaroneck, N. Y.*

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ARE BUILT TO FIT *Your* JOBS!

The reason why Viking Pumps so successfully handle all types of clean liquids, regardless of viscosity, is that they are built from start to finish for your job in the size and style YOU need.

Ruggedly built with no small intricate parts. They are self-priming with low speed, even and steady discharge which assures good, dependable service.

Write today for free bulletin 47SW.

See Our Catalog In SWEETS

VIKING PUMP COMPANY
CEDAR FALLS, IOWA

52 **DIESEL PISTON RINGS**—Cooktite Ring Sales Co, 1737 Howard Ave, Chicago, Ill. 8-page bulletin, entitled "Save One Out of Ten Gallons of Fuel," gives facts one should know about Cooktite piston rings.

53 **STEAM TURBINE GOVERNOR**—General Electric Co, Schenectady 5, N. Y. 4-page bulletin No. GEA-4764 contains details of an electric governor for GE TYPE DE steam turbine. Salient features of the governor's components are revealed in cutaway photos.

54 **MARINE DIESEL ENGINES**—Superior Engine Div, National Supply Co, Springfield, Ohio. 28-page bulletin No. 4704 describes how Superior marine diesels are designed and built, both main propulsion engines and engines for auxiliary power in all types of ships.

PUMPS

55 **CENTRIFUGAL PUMPS** — Allen-Sherman-Hoff Co, 225 S 15th St, Philadelphia, Pa. 16-page catalog features Hydroseal pumps, which are used for pumping ashes to overhead storage bins and distant low lands for fill.

56 **INDUSTRIAL PUMPS**—American Manganese Steel Div, American Brake Shoe Co, Chicago Heights, Ill. 8-page bulletin No. 547-IP describes Amsco-Nagle ball-bearing Type T industrial pumps. Photos, diagrams and cross-sectional views explain features of Amsco manganese-steel water-end parts.

57 **CENTRIFUGAL AND PISTON PUMPS**—Scranton pump div, Condenser Service & Engrg Co, 1445 Meylert Ave, Scranton, Pa. 24-page catalog L gives construction and application of Conseco centrifugal and piston pumps.

58 **STEAM SLUSH PUMP**—National Supply Co, Box 899A, Toledo 1, Ohio. 16-page bulletin No. 326 contains eight photos, a blueprint, performance chart and complete specifications on Ideal steam slush pump Type S-935.

59 **PEDESTAL CENTRIFUGAL PUMPS**—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 4-page bulletin No. 52B6691 gives operating advantages and construction features of new line of Pedrifugal pedestal centrifugal pumps.

60 **TURBINE PUMPS**—Walter H Eagan Co, 2336 Fairmount Ave, Philadelphia, Pa. 4-page bulletin No. 8A describes Eagan turbine pumps for capacities to 250 gpm and pressures to 200 psi.

61 **CENTRIFUGAL PUMP**—Peerless Pump Div, Food Machinery Corp, 301 West Ave 26, Los Angeles 31, Calif. 8-page bulletin No. B-165 presents a single-stage end-suction vertically-split case centrifugal pump, designated as the Fluidyne.

62 **HYDRAULIC PUMPS**—Eaton Mfg Co, 739 E 140th St, Cleveland 10, Ohio. 40-page bulletin, 1947 edition, entitled "Products of Eaton," describes Eaton's current principal products for the industrial markets. Bulletin covers hydraulic pumps, truck axles, engine valves, valve lifters and tappets, valve seat inserts, coil springs, leaf springs, etc.

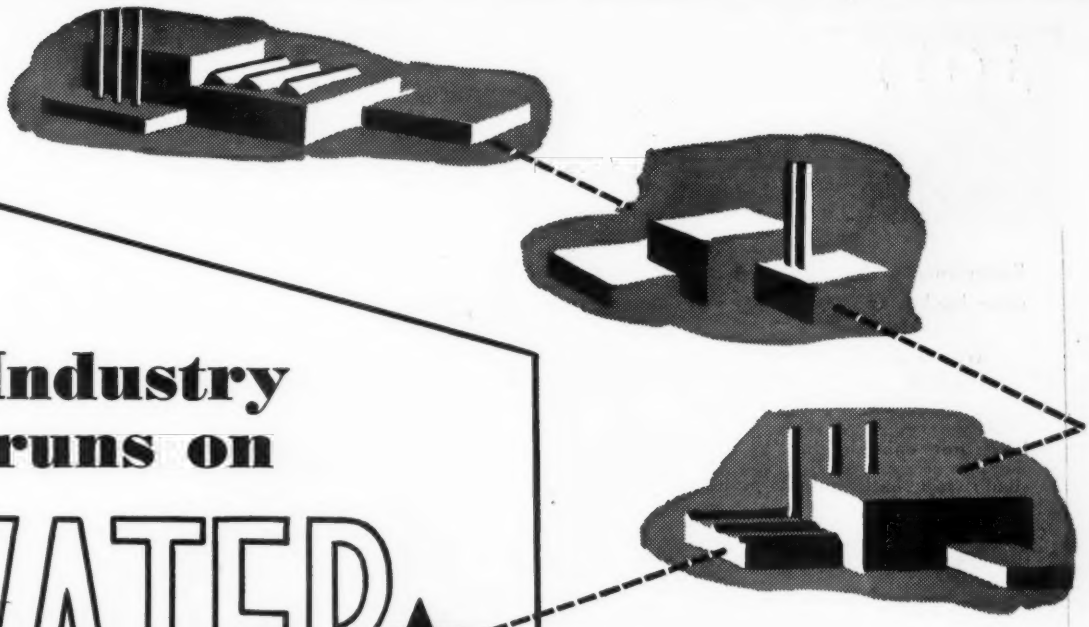
WELDING

63 **WELDING AND CUTTING EQUIPMENT** — Victor Equipment Co, 844 Folsom St, San Francisco 7, Calif. 20-page catalog shows a comprehensive portion of line of Victor gas welding and flame-cutting apparatus.

64 **SILVER BRAZING**—Handy & Harman, 82 Fulton St, New York 7, N. Y. 4-page bulletin No. 15 describes Easy-Flo 45, a recently announced silver brazing alloy with several new features.

65 **WELDING MACHINE** — Niagara Machine & Tool Works, 637 Northland Ave, Buffalo 11, N. Y. 12-page bulletin No. 83 gives operation and construction of Niagara electronic automatic welding machine.

66 **ARC-WELDING ACCESSORIES**—Metal & Thermit Corp, 120 Broadway, New York 5, N. Y. 16-page bulletin No. 120 covers cable connectors, cable lugs, cable splicers, cleaning tools, cover plates, eye shields, ground clamps, hammers, hand shields, helmets, holders, lenses, protective clothing, spectacles and welding cables.

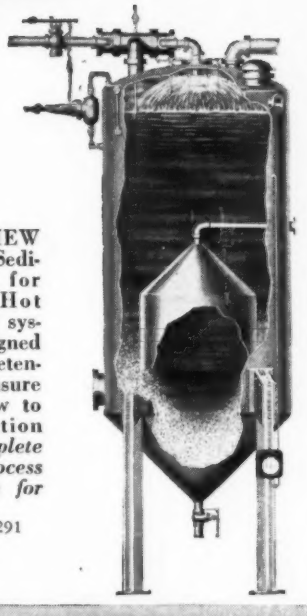


Industry runs on WATER

BUT WATER IS SELDOM SUITABLE FOR INDUSTRIAL PURPOSES WITHOUT SOME KIND OF TREATMENT

PREVENTION of scale, carryover and corrosion in power plants depends on the proper treatment of boiler feedwater. It means using the right kind of water conditioning equipment and chemicals, selected only after carefully considering such factors as the character of the raw water, amount of make-up, type of steam load, and the design characteristics of steam generators and prime movers. These and other essential considerations demand that you place your water conditioning problems in the hands of experienced experts who can select impartially from a complete range of water conditioning equipment.

Allis-Chalmers long and extensive experience in conditioning boiler feedwater for thousands of power plants — both high and low pressure — qualifies them to assist you in selecting the right kind of water treating equipment for your plant. Their "know-how," coupled with the complete range of Allis-Chalmers water conditioning equipment, is your assurance of the right solutions to your water treatment problems.



SECTIONAL VIEW of Reaction and Sedimentation tank for Allis-Chalmers Hot Process Softening system. Tank is designed to allow ample retention time . . . insure straight-line flow to minimize convection currents. *For complete details on Hot Process Softeners, write for Bulletin 28B6611.*
A 2291

Whatever your water conditioning requirements are, Allis-Chalmers can supply the proper equipment . . . Hot and Cold Process Softeners . . . Sodium and Hydrogen Zeolite Softeners . . . Degasifiers . . . Deionizers . . . Chemical Proportioning and Feeding Equipment . . . Chemical, Booster and Filter Backwash Pumps . . . Oil Removal and Water Filters. Call your nearest A-C office or write: ALLIS-CHALMERS, MILWAUKEE 1, WIS.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great

JOIN THE TREND –
Experience with both Proves Open Bucket Best

Experience of steam trap users has proved that, for smoother operation, open bucket type traps are superior for all-round service.

"Cub" discharges both air and condensate

It is not enough that a WRIGHT-AUSTIN "Cub" steam trap shall efficiently remove air and condensate from service lines—it must be qualified to live up to the expectations of every user. That it does this is proved by the large volume of repeat orders.

These are the qualities you will find in "Cub" open bucket type steam traps—qualities which contribute to world-wide acceptance and use:

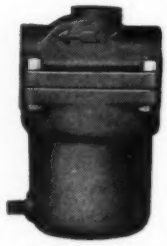
Double Rating on continuous discharge

No Waste of Steam

Stainless Steel valves, seats and buckets

Easy to Install

Water Seal entirely within trap



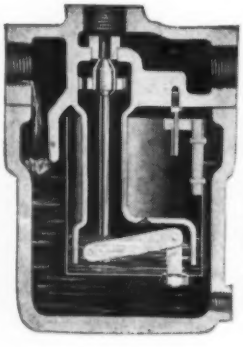
No. 50 "Cub" Airxpel Open Bucket type Steam Trap

No. 51 "Cub" Airxpel Open Bucket type Steam Trap

All sizes of "Cub" Steam Traps are suitable for pressures up to 250 psi. Other types of Airxpel Steam Traps available for pressures up to 700 psi.

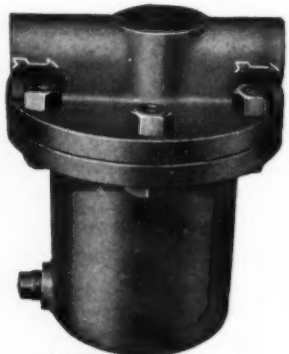
You'll find complete details in Circular 259-A.

Send for a copy today.



Inside the "Cub"

This view shows the inside water seal which prevents waste of steam. It shows also straight through pipe connections and accessibility of valve and seats.



No. 52 "Cub" Airxpel Open Bucket type Steam Trap

Send for Circular 259-A

WRIGHT-AUSTIN COMPANY

316 West Woodbridge St. Detroit 26, Mich.

WA Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN

SERVING INDUSTRY FOR MORE THAN 50 YEARS

67 **WELDING ELECTRODES**—Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. Welding procedure sheet, entitled "Ampco Procedure for Welding Dissimilar Metals," covers use of Ampco welding electrodes and gives data on selection of electrodes recommended amperage and voltage procedures, necessary heats, polarity and current requirements, etc.

68 **ARC WELDERS**—Hobart Brothers Co, Troy, Ohio. 4-page bulletin No. J-1893 gives construction and operation of Hobart multirange arc welders. 4-page booklet No. J-1477 covers Hobart gas-drive arc welder with auxiliary dc power generator.

OTHER EQUIPMENT

69 **FANS AND BLOWERS**—Roots-Connersville Blower Corp, 900 W Mount St, Connersville, Ind. 8-page bulletin No. 23-120-B10 describes fans and blowers, boosters, pumps and meters for sewage disposal plants and water works.

70 **LOW-TEMPERATURE INSULATION**—Industrial Mineral Wool Institute, 441 Lexington Ave, New York 17, N. Y. 24-page manual, entitled "Holding Low Temperatures with Better Insulation," covers how to select insulation; data on forms, properties and application methods; and principles and significance of vaporproofing for various wall, floor and ceiling construction.

71 **SIGNAL AND CONTROL EQUIPMENT**—Autocall Co, 527 Tucker Ave, Shelby, Ohio. 8-page brochure covers line of electrical signal and control equipment for public utility and industrial power plants. 16-page catalog discusses power plant supervisory systems.

72 **MEASUREMENT SYSTEMS**—General Electric Co, Schenectady 5, N. Y. 28-page booklet No. GET-1344 contains a comprehensive functional analysis and classification of measurement systems and an outline of their historical development.

73 **COOLING WATER TREATMENT**—Liquid Conditioning Corp, 114 E Price St, Linden, N. J. Bulletin No. 10 discusses prevention of scale formation and corrosion in the water used for equipment cooling.

74 **EQUIPMENT COVERING** — Falstrom Co, Passaic, N. J. 4-page booklet describes equipment covering that is functional in design. Manufacturer aims to improve equipment serviceability and ease of operation by better planning for equipment exterior.

75 **HEAVY MACHINERY**—Caterpillar Tractor Co, Peoria 8, Ill. 12-page booklet, Form No. 10,000, entitled "Caterpillar Progress Through The Years," reviews the birth of heavy machinery and traces strides taken to present today's efficient and productive equipmnt.

76 **FRAME CONSTRUCTION** — Unistrut Products Co, 1013 W Washington Blvd, Chicago 7, Ill. Forms GB-1, BT-2, CI-1 and S-3 describe applications of Unistrut, a single all-purpose structural framing member, for building frame for supporting or holding pipes, conduits, etc.

77 **FLUX-INJECTION CUTTING**—Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 12-page reprint, entitled "Flux-Injection Cutting of Stainless Steels," by G E Bellew, covers fundamentals, capacities and advantages of flux-injection method.

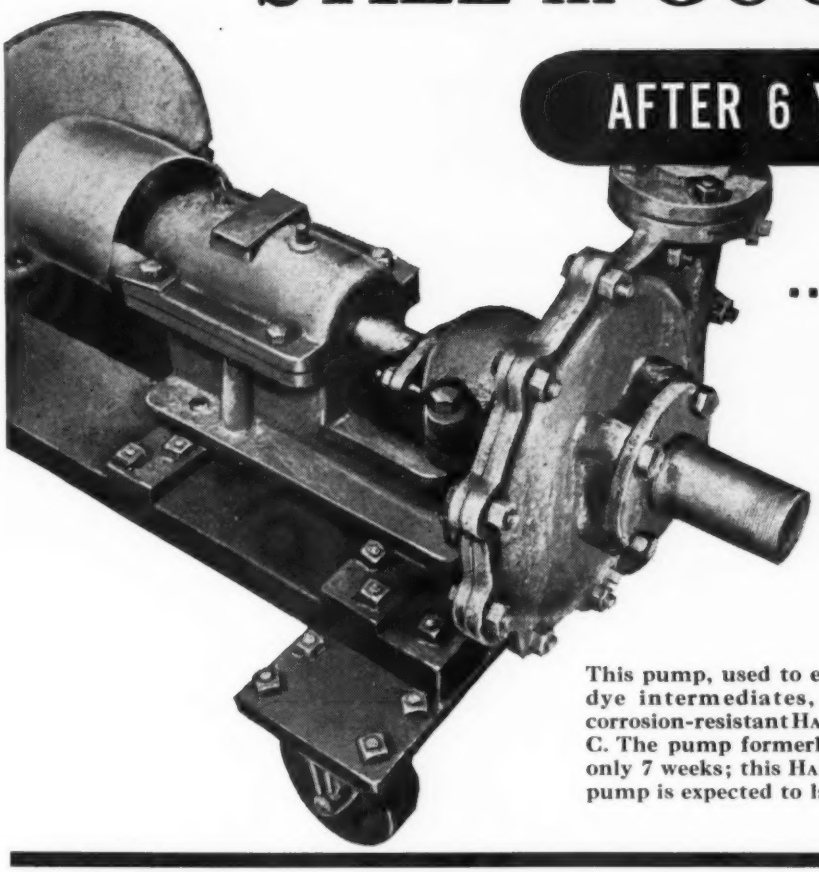
78 **MAJOR POWER UNITS**—Worthington Pump & Machinery Corp, Harrison, N. J. 4-page folder, entitled "News from the Power Front," describes plant installations of various company products, including diesels, boiler feed pumps, hydraulic pumps and rotary pumps.

79 **REFERENCE TABLES**—Leslie Co, Lyndhurst, N. J. 12-page bulletin No. 467, entitled "Engineering Data and Reference Tables," is a collection of handy data for calculations on piping, pumps, heaters, traps, reducing valves, temperature regulators, pump governors, pressure controllers, etc.

80 **OXACETYLENE CUTTING** — Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 12-page reprint, entitled "Oxyacetylene Cutting in Sheet Metal Work," by R F Helmkamp, covers fundamentals of machine gas cutting, equipment necessary and operation cost. Specific shop applications are given.

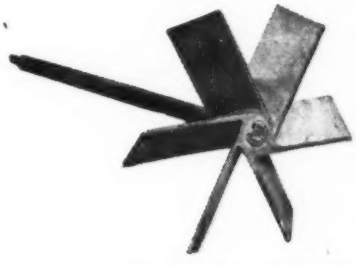
STILL in GOOD SHAPE-

AFTER 6 YEARS OF SERVICE

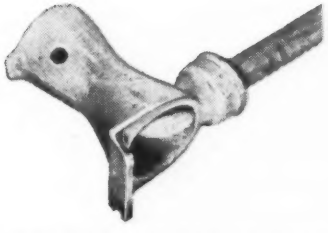


...HASTELLOY Alloy C Parts Resist Corrosive Action of Dye Intermediates

This pump, used to empty vats of dye intermediates, is made of corrosion-resistant HASTELLOY alloy C. The pump formerly used lasted only 7 weeks; this HASTELLOY alloy pump is expected to last 10 years.



HASTELLOY alloy C agitator shaft and blades are used in a reaction vat. Whip and unbalance in the agitated fluid often places considerable stress on the shaft; high-strength HASTELLOY alloy is not affected by this stress.



This steam jet of cast HASTELLOY alloy C is also used in a reaction vat. After 6 years service in acids, alkalies, and strong oxidizing agents, the jet is still in good operating condition.

Write for the booklet "HASTELLOY High-Strength Nickel-Base Corrosion-Resistant Alloys" for information on available forms and methods of fabrication.

HASTELLOY
TRADE-MARK

Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Chicago — Cleveland — Detroit — Houston — Los Angeles — New York — San Francisco — Tulsa

"Hastelloy" is a registered trade-mark of Haynes Stellite Company.

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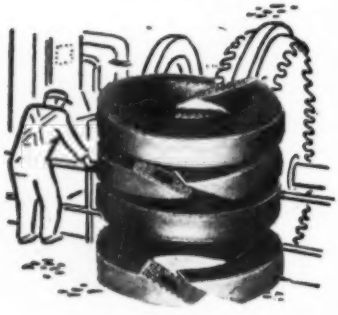
PACKINGS
solve sealing problems

These three packings are representative of the extra values built into each product in the complete Belmont line. For every service . . . steam, water, oil, gas, acids, alkalis, ammonia . . . your Belmont Distributor has the right packing.

BELMONT #30 For High Pressure Steam Rods and Expansion Joints. Center block pleated on itself (accordion fashion) at approx. 90° angle with rod, affording, high resiliency and flexibility, extra take-up, extra "edge wear" if packing wears toward the rod.

BELMONT #189 For Hot Oil Rods and Plungers. Has extra resistance to penetration. Long-fibre asbestos yarn is firmly braided, each strand treated with a special compound so that saturation and penetration are minimized.



BELMONT #19 Hollow Center Packing For Intermediate and Low Pressure Steam; Hot and Cold Water Rods and Plungers. Hollow Center permits expansion and contraction. Packing "breathes" toward the hole, so friction is kept at minimum point created by the working pressure itself.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

Belmont Packings are available in every large industrial center, through Belmont Distributors.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia

Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

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BUTLER AND SEPVIVA STREETS • PHILADELPHIA 37, PA.

APPOINTMENTS

General Electric Co has announced five appointments within the turbine-generator engineering div: W E Blowney and P H Knowlton were named assistant div engineers; Alan Howard was made section engineer of gas-turbine section; E E Parker was named section engineer of steam-turbine section; and H D Taylor became section engineer of generator section. R W Kise has become manager of sales of industrial heaters and devices section. Robert O Bullard has been made manager of metallurgy div of the chemical dept. After 46 years of service with GE, F J Rudd, managing engineer of motor engineering div at Lynn, Mass., has retired from the company at his request. Reginald G Standerwick, engineer of aircraft gas-turbine div at Lynn, Mass., has retired at his request after 38 years of service.

Raymond R Rausch has been retained as a consultant to **General Electric Co** on manufacturing matters. Rausch will serve as a member of manufacturing group on staff of C E Wilson, GE president. His headquarters will be at 570 Lexington Ave, New York City. B A Case has been appointed a member of design-engineering staff of apparatus dept. In addition to following engineering activities of certain assigned divisions of the dept, he will coordinate all phases of engineering cost reduction. Elmer E Sheldon has become quality-control engineer of wire and cable div at Bridgeport, Conn. W R Becker has been named product-promotion manager for wiring device sales. James A O'Donnell has been made district representative for conduit products in Great Lakes district, with headquarters in Cleveland. Kenneth D Sargent became district representative for wiring devices in central district.

Babcock & Wilcox Co has named L L DeWolf superintendent of marine erection. M Nielsen became production superintendent of Barberton, Ohio, works.

William L Prout has been appointed chief engineer of **Green Fuel Economizer Co.** He succeeds Clinton S Messler, who will continue as vice-president in charge of engineering and production.

D A Griffith became assistant to J W McMullen, general manager of **Allis-Chalmers'** Pittsburgh works.

Electric Machinery Mfg Co announces establishment of a new sales office in Dallas, Tex. H L Renking will be in charge.

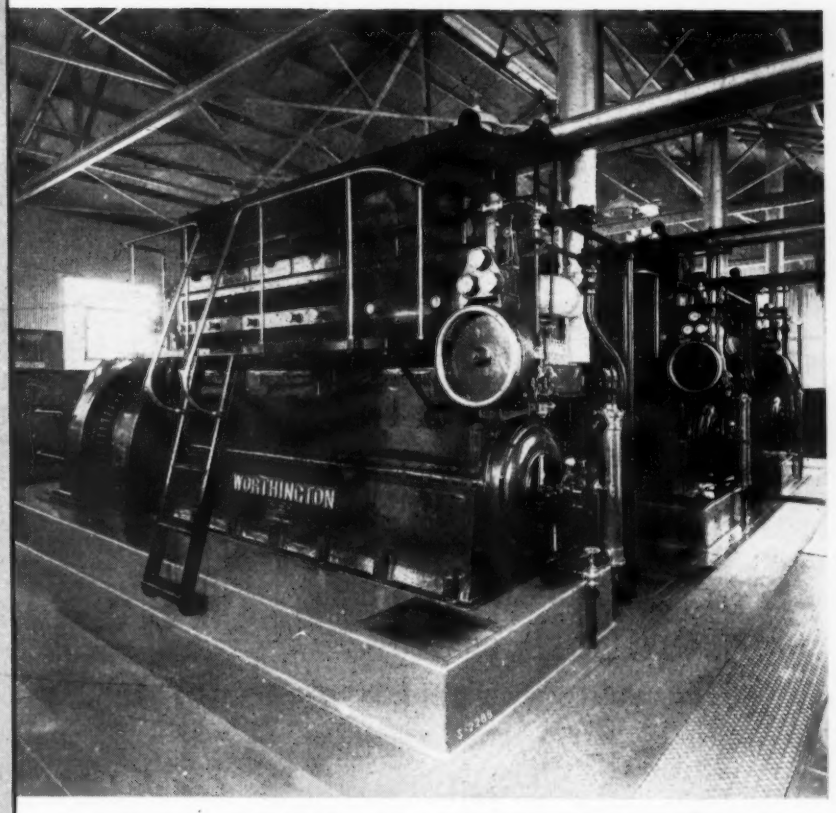
Lyle A Christensen has been promoted to general sales manager of **Marley Co.** Ray T Jenkins has been made assistant general manager.

Onni Lindfors has been promoted to chief electrical engineer of Freeport, Ill., plant of **Fairbanks, Morse & Co.**

Carroll V Roseberry has been appointed assistant Pacific Coast district manager for central station div, **Westinghouse Electric Corp.** Walker G White and Harry

BEFORE YOU BUY A DIESEL OR GAS ENGINE

Check These Worthington Features Approved by Power-Wise Purchasers



Three Worthington CCG-6 Engines Serving The Continental Oil Co., Griffin, Indiana

✔ **Four-Cycle Design** . . . The sustained high economy and dependability of this design, as engineered by Worthington, have been proved beyond question.

✔ **Rugged Construction** . . . Rigid enbloc frame, large crankshaft, four-bolt main and connecting rod bearings and gear-driven camshaft assure extra-long service life.

✔ **Trouble-Free Operation** . . . Conservative ratings, full force-feed lubrication, total enclosure and controlled cooling are typical Worthington features for safety-plus reliability.

✔ **Turbo-Charging (Available)** . . . Increased efficiency and more power in the same space cut fuel, maintenance and installation costs.

Only Worthington Has ALL These Features!

Which explains why there are over 2,000,000 Worthington Diesel and gas engine hp now in service, in every part of the world . . . and why *there's more worth in Worthington.* Get this complete story of how gas or oil fuel can be converted into maximum power at lowest cost. Write to *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.*

WORTHINGTON

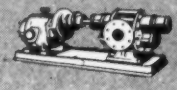
E7-3

YOUR PARTNER IN POWER PROGRESS

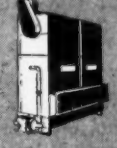
Diesel engines, 150 to 3,520 hp . . . gas engines, 175 to 3,290 hp . . . dual fuel Diesel engines, 225 to 3,290 hp.

WORTHINGTON-BUILT AUXILIARIES

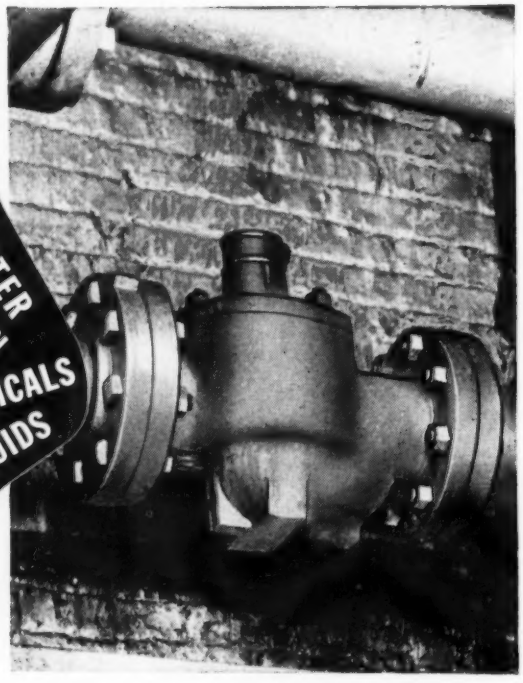
Air King Compressors


Oil Transfer Pumps

Cooling Water Circulating Pumps

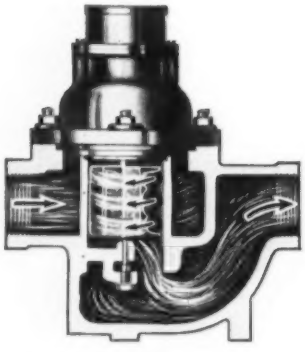

Evaporative Type Engine Water Cooler

BOILER FEED WATER
HOT DIRTY BLOWDOWN
CONDENSATE
FREE-RUNNING CHEMICALS
HARD-TO-MEASURE LIQUIDS



ALL ACCURATELY MEASURED
with a
HENSZEY *Feed Water* METER

These simple, rugged meters can be installed right in the line without additional structural supports. The straight reading horizontal register accurately records any liquid at high or low flow — high or low pressure — on centrifugal or reciprocating pumps. Calibrations can be made to read in gallons, pounds or cubic feet at any specified temperature.



SIMPLICITY WITH ACCURACY

Liquid enters the measuring chamber tangentially, spinning in the chamber as it passes through, forming a vortex. Each unit of liquid passing through this chamber makes the same number of revolutions. A vane placed in the liquid imparts this rotation to the calibrated register. A minimum of working parts without close clearances.

For your tough liquid measuring job, where stamina with accuracy is required . . . consider a Henszey Meter. Contact your nearest Henszey Representative or write to

HENSZEY COMPANY
DEPT. D9, WATERTOWN, WISCONSIN

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Boiler Feed Regulators • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

W Tenny have been made operating managers of elevator div at Jersey City, N. J. Dr Harvey C Rentschler retired July 1 after a 30-year career of directing Westinghouse lamp and electronic tube research at Bloomfield, N. J. Dr Charles M Slack succeeds Rentschler.

Ransome Machinery Co, a subsidiary of Worthington Pump & Machinery Corp, has appointed Allen B Kime as Eastern regional manager in charge of sales of Ransome positioning and turning roll equipment. Kime's Eastern regional headquarters will be at the Ransome plant, Dunellen, N. J.

Air Reduction Sales Co has opened a new acetylene plant in Dayton, Ohio. The plant superintendent will be R K Haygood.

Industrial dept of **Dravo Corp** opened a Chicago office to handle sales and service of Dravo Counterflo direct-fired heaters and Dravo crane cab coolers. The Chicago office covers northern Ill. and industrial districts of northwest Ind. T W Eshbach is in charge of the new branch office.

Monsanto Chemical Co appointed Chester L Jones Jr sales manager of protective coatings dept. His headquarters will be at Merrimac div at Boston, Mass. Richard D Dunlop has been named technical director in charge of research and development of Texas div, with headquarters in Texas City. Dr R M Hitchens was elected research director of organic chemicals div. Dr Hitchens succeeds Dr Lucas P Kyrides, who recently resigned. Dr O J Weinkauff was promoted to associate director. Dr F B Zienty and Dr L L Fellinger were promoted to assistant directors. Albert H Bump was made senior industrial scientist of the company.

A W Baird has been elected purchasing agent of Spang-Chalfant div of **National Supply Co.** J M Taylor has been made assistant purchasing agent of this div.

H K Porter Co has appointed John F Cunningham Jr manager of J P Devine Mfg Co plant at Mt. Vernon, Ill.

Durling Electric Co, 2002 St. Paul St, Baltimore 18, Md., has been appointed representative for **Ward Leonard Electric Co** in Va., south central Pa., Md., except for Washington area, and Del. south of Wilmington.

Carborundum Co bought former assembly plant of Philco Corp at 3345 W 47th St, Chicago. After additions and alterations, the building will become the Chicago sales offices and warehouse of Carborundum and will be under direction of C E Hawke, domestic sales manager, W C McCargo, regional sales manager, with Gordon C Watson in charge as district sales manager.

Gaybex Corp removed its offices and manufacturing from Nutley and Delawanna, N. J., to larger quarters at 70 Lister Ave, Newark, N. J. Gaybex appointed following sales representatives: (1) Apex Engrg Co, Chicago, for Chicago and North Shore area (2) Badger Associates, Oshkosh, for

ALLIS-CHALMERS ANNOUNCES A

New Small Pump

OF UNUSUAL VERSATILITY

THE NEW *"Pedrifugal"
Pedestal Type
CENTRIFUGAL PUMP

HERE'S A BRAND NEW addition to the Allis-Chalmers line of fine centrifugal pumps!

★ It's small, compact, efficient — offers endless variations in capacity and head — suits a hundred jobs — fills a long-felt need.

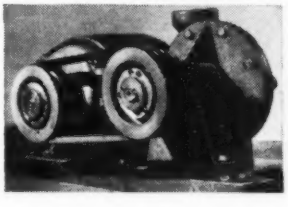
★ It's economical to buy and operate — soundly engineered in every detail — built to highest standards of materials and workmanship.

★ It's backed by Allis-Chalmers 65 years of engineering leadership in building centrifugal pumps!

Allis-Chalmers new "Pedrifugal" pump is made in 1″ by 1″, 2″ by 2″ and 3″ by 3″ sizes—capacities to 500 gpm—heads to 100 ft.—up to 15 hp. Ask your nearest Allis-Chalmers office or dealer for the new "Pedrifugal" Pump Bulletin 52B6691. A2305

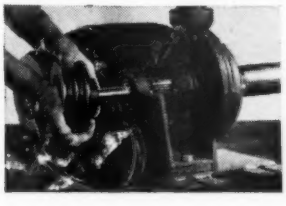
ALLIS-CHALMERS, MILWAUKEE 1, WIS.

*Allis-Chalmers Trademark



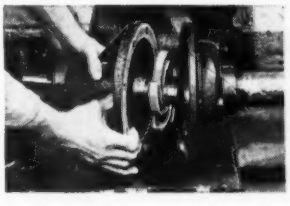
Buy It "Off the Shelf"

Pump can be bought "bare" or as a complete unit; pump, motor, Texrope drive and welded steel base. Also can be coupled or belted to a motor, a gasoline engine or power take-off.



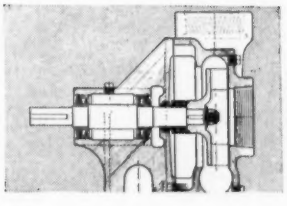
V-Belt Drive Gives Great Range of Capacity

Specially designed for flexible TEXROPE V-belt drive. Changing one sheave quickly changes speed and capacity of the pump . . . gives great flexibility.



Designed and Built for Simplified Maintenance

All moving parts quickly accessible without disconnecting pipes. No packing rings to replace . . . bearings have 3 to 5 year supply of grease under normal operation.



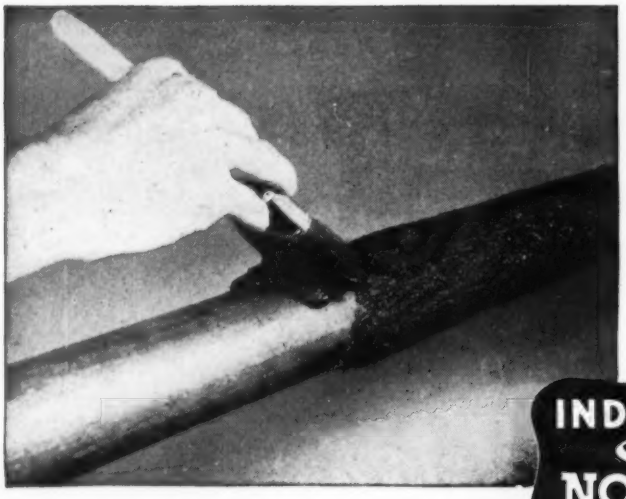
High Grade Construction

Two large ball bearings, grease sealed. . . . High grade mechanical shaft seal. . . . Heavy 1 in. machined shaft, with key ways and impeller lock nut. . . . Bronze open type impeller. . . . Heavy, generous design.

ALLIS·CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great



COVER PIPES, TANKS, WALLS,

with

INDUSTRIAL NoDrip

Anyone can brush, trowel or spray NoDrip on any clean, dry surface. Goes on like plaster, forms a seamless, protective coating which effectively ***stops condensation drip.***

NoDrip keeps equipment and floors safe and dry; prevents corrosion of metal and prolongs its life. Acid, alkali and brine resistant. Comes in 1, 5 and 55 gallon drums, ready for use.

TRY NoDrip

Apply NoDrip to a small area, compare the results with uncovered portions.

Send for Free NoDrip Handbook

J. W. MORTELL CO. 549 Burch St., Kankakee, Ill.

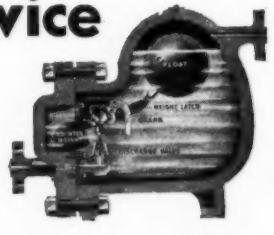
STOP LIVE STEAM LOSS in Superheat Service

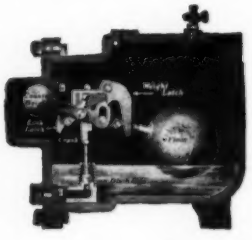
with

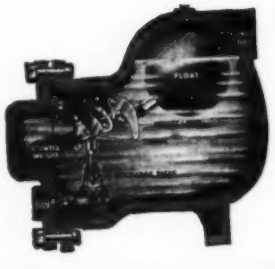
NICHOLSON

LEAK-PROOFED

Weight-Operated Traps







If you are losing live steam in your superheated service, because traps dry up and leak, Nicholson weight-operated traps offer a now widely adopted remedy. Though "cooked" dry, the valve of these traps holds tight due to their weight operation.

SUBSTANTIAL SAVINGS — Steam and fuel savings in substantial quantities are reported from installations of Nicholson weight-operated traps. 4 types; pressures to 1500 lbs. Stainless steel working parts.

Catalog 444 or see Sweet's

W. H. NICHOLSON & CO.

125 OREGON ST., WILKES-BARRE, PA.

Valves • Traps • Steam Specialties

State of Wis. (3) Howard S Wharton, Delray Beach, for State of Fla. (4) Harris Pump & Supply Co as sole industrial supply distributors for Pittsburgh, Pa., district (5) S E Newman as resident representative for western Pa. and W Va.

Harold C Anderson has been elected vice-president of research engineering and development of **Thermoid Co.** L R Leaver has been made president of the Thermoid subsidiary, Joseph Stokes Rubber Co, Ltd, of Welland, Ont., Canada. W D Pardoe was elected a director of this subsidiary.

Nelson Electric Corp announced appointment of H N Leuckel as purchasing agent.

D F Wenzel has been made manager of sales of Wisconsin office of **Globe Steel Tubes Co,** with headquarters in Milwaukee. He replaces T R Coffey, who has been transferred to the Detroit office as manager of sales.

Frabimor Equipment & Controls Co has been named exclusive representative in Chicago and Milwaukee areas for Kieley & Mueller, Inc, Continental Equipment Co, J A Campbell Co, Photoswitch, Inc, Wedgeplug Valve Co, Delta Engrg Co, Newark Boiler Regulator Co.

Wilber F Pray has been elected New York district manager of **Askania Regulator Co.** New York district office will be at 92 Gold St, New York 11, N. Y.

Aldrich Pump Co announced that Petroleum Machinery Co, 30 Rockefeller Plaza, New York City, has been appointed industrial representative in the New York area. The marine field will continue to be represented by William O Mulheron, 11 Broadway, New York City.

Frederick A Meyer has been named representative of **Burlington Instrument Co.** Meyer's headquarters will be at 207 E Michigan St, Milwaukee 2, Wis., his territory including State of Wis. and upper peninsula of Mich.

Three changes in personnel of district offices of **SKF Industries, Inc,** were announced: (1) Roy C Norton Jr was made field engineer in Hartford, Conn., district office. (2) I J Torkelson, field engineer, was transferred to Milwaukee branch. (3) R M Parrish was appointed to sales staff of Portland, Ore., district office.

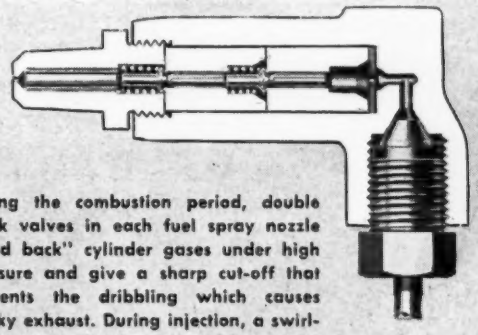
Skinner Engine Co has named Stuart D Brown, 401 Broad St, Sewickley, Pa., as district sales representative in Pittsburgh area.

Oliver F Gang was elected president, director and general manager of **Ludlow Valve Mfg Co,** succeeding Alfred W Thompson, who became chairman of executive committee. Thompson also continues as treasurer.

Grinnell Co has acquired the B Hoffman Mfg Co, Milwaukee, Wis. The branch will be known as B Hoffman Mfg Co div and will serve the southern section of Wis. formerly covered from Chicago. Thomas R

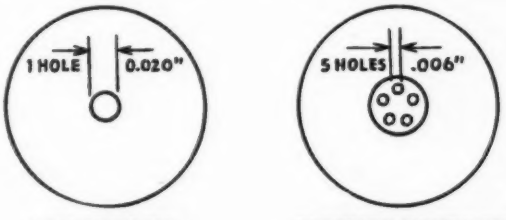
TYPE "S" *Injection System*

GIVES BETTER COMBUSTION AND LOWER MAINTENANCE



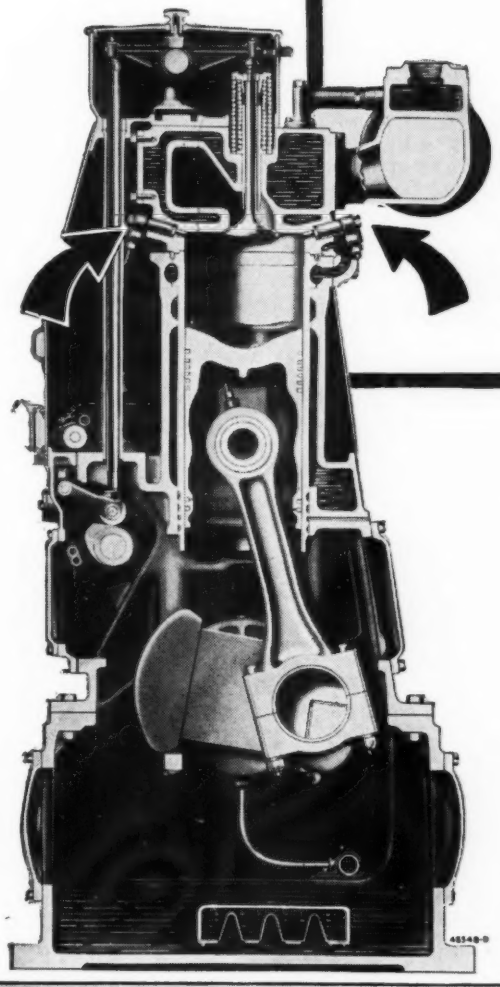
During the combustion period, double check valves in each fuel spray nozzle "hold back" cylinder gases under high pressure and give a sharp cut-off that prevents the dribbling which causes smoky exhaust. During injection, a swirling motion is imparted to the sprays emerging from the nozzle tips for complete fuel dispersion.

ADVANTAGES OF THE SINGLE HOLE INJECTION NOZZLE



I-R NOZZLE TIP — ORDINARY NOZZLE TIP

The single large-diameter hole will pass foreign particles many times larger than the multi-hole, small-opening nozzle. Because of this feature, plugging of the nozzles is almost non-existent. To the experienced Diesel operator and maintenance man, this advantage is self-evident.



In 26 years of pioneering in solid fuel injection, Ingersoll-Rand has perfected an injection nozzle which is outstanding not only for its primary purpose of injecting fuel, but also for its simplicity and low maintenance.

These are the principle features of the Type "S" system:

1. **Location of the nozzle permits its removal without disturbing the cylinder head, the fuel injection pump, or its actuating mechanism.**
2. **Design of nozzle permits it to be completely taken apart for inspection or cleaning by unscrewing the nozzle tip.**
3. **The single large-diameter hole in each nozzle prevents plugging of nozzle.**
4. **Double check valves prevent dribbling.**

Ask for bulletin 10,310. It gives the complete story of these 720-rpm, 4-cycle Diesels which Ingersoll-Rand builds in sizes from 225 to 600 hp. For information on the "Super S" turbocharged Diesels ask for Form 10,311. This engine is built in 6, 7 and 8 cylinder sizes from 675 to 900 hp.

COMPRESSORS • AIR TOOLS
ROCK DRILLS • TURBO BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS
OIL AND GAS ENGINES

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 7-758

Pumping Hot, Bituminous Coatings Demands Top Pump Performance

Pumping hot, bituminous coatings of high specific gravity and abrasive quality against a static head of approximately 40 feet at the rate of 45 to 50 gallons per minute is the tough job performed by the standard Deming Pump illustrated.

"In our 25 years of experience we have found this Deming pump to be the most satisfactory for the purpose," said Mr. Milton M. Bowen, Vice President, Hill, Hubbell & Co., a Division of General Paint Corporation. The Deming Pump is a (Figure 4022) No. 2, side suction, two ball bearing centrifugal pump connected through flexible couplings with a 10 H. P. 3 phase, 220 volt motor.

An important feature of the pump is its special chromium plated shaft sleeve which minimizes the possibility of stuffing box failure, an obstacle encountered by every pump used prior to the installation of the Deming Pump.

Another noteworthy feature of this pump is its separate liquid end construction which permits economical replacement of the few parts subjected to constant wear after long service.

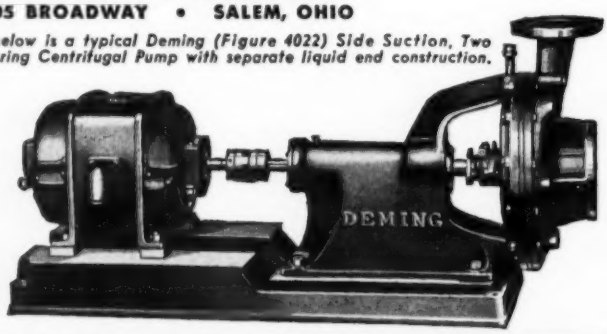
This schematic drawing illustrates a typical HILL, HUBBELL specification for *factory applied* steel pipe protection against electrolytic and all other kinds of corrosive action. HILL, HUBBELL processed steel pipe is widely used in inter-state and intra-state oil and gas pipe lines.

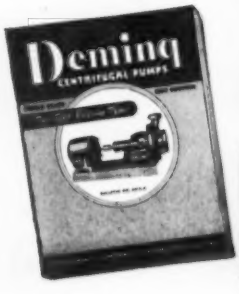
Complete details of construction, performance tables, and related information about this type of Deming Pump are included in a new, illustrated BULLETIN NO. 4012-A. Write for your copy.

THE DEMING COMPANY
205 BROADWAY • SALEM, OHIO

SEND FOR BULLETIN NO. 4012-A

Shown below is a typical Deming (Figure 4022) Side Suction, Two Ball Bearing Centrifugal Pump with separate liquid end construction.





DEMING
THE COMPLETE LINE
PUMPS AND WATER SYSTEMS

Horan has been appointed branch manager. B Hoffman Jr, president of the Milwaukee company since 1914, will serve as consulting manager of the new branch. A E Gauslin, Milwaukee manager of fire protection div of Grinnell, will move his offices to the new branch location.

Preston M Postlethwaite has been appointed manager of both electrical and automotive divisions of **Wagner Electric Corp** branch at Portland, Ore.

Corning Glass Works formed a central sales district, with offices in Chicago, for technical products div. John D Brown was named manager of the new district. Hugh Harris was appointed manager of Chicago office.

William Ludvik has returned to **McAlear Mfg Co** as president and general manager. This announcement is part of one concerning the recent successful negotiations by Ludvik for acquisition of entire stock, plant and equipment of McAlear div in Chicago from Climax Industries, Inc.

Link-Belt Co has elected Harold L Hoefman vice-president in charge of manufacturing, with headquarters at executive offices, 307 W Michigan Ave, Chicago. David E Davidson has been named general manager of Pershing Rd plant, succeeding Hoefman. Joseph C Spence has been elected assistant to Hoefman. Ralph W Rausch has been appointed chief engineer, succeeding C S Huntington, who has retired because of ill health. H Walter Regensburger has been made divisional engineer in charge of estimate engineering at Pershing Rd plant. Eugene P Berg has been named general superintendent of this plant.

A E Higgins has been named vice-president of **Rockwell International Corp,** New York City.

Livingstone Engrg Co has elected Frederick J Riker president.

Thomas B Moule, who served as assistant director of sales in Los Angeles office of **Plomb Tool Co,** has been assigned responsibility of supervising Plomb's expanded sales organization in eastern half of the U. S. His headquarters will be temporarily at the company's sales office at 549 W Washington St, Chicago. Jack G Allen has joined the sales staff to take over duties previously handled by Moule and to supervise export dept.

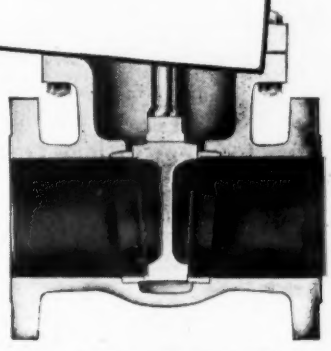
Consolidated Industries, Inc, announces appointment of Kirby Walker as chief engineer.

Robert L Stickley has been named distributor promotion specialist of **Carboloy Co.** Stickley succeeds T D Emerson, who resigned.

Buffalo Niagara Electric Corp has named J Norton Ewart as chief mechanical engineer, succeeding C C Whelchel, who resigned. Franklin S Helfter, who has been assistant superintendent of the Huntley steam stations, is appointed superin-

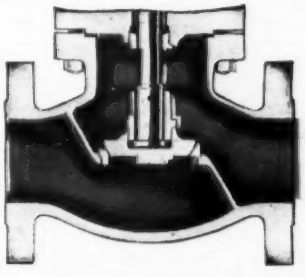
Streamline YOUR PIPELINES WITH OIC PACE SETTER IN VALVES

Free-Flow OIC Steel Valves Cut Pumping Costs . . . Give You *Maximum* Flow With *Minimum* Pressure Drop!



Streamlined.....

OIC GATE VALVES with flanged and welding end provide straight-through flow without recesses or pockets between the valve ports and seat openings. Screwed end valves are designed for the smoothest possible flow with a threaded joint.

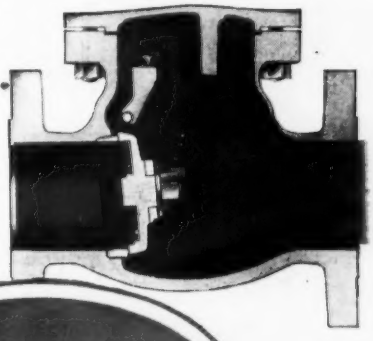


Streamlined.....

OIC GLOBE AND ANGLE VALVES are designed with a disc guiding in all pressure classes to eliminate the necessity of a bridge across the seat opening, thereby reducing pressure loss through the diaphragm to a minimum. Flow of the line fluid, whether gaseous or liquid, is expedited.

Streamlined.....

OIC CHECK VALVES have bodies designed for unobstructed flow where the disc is in the wide open position. Streamlined internal contours from port to port reduce turbulence and consequent pressure loss to a minimum.



SEND FOR NEW CROSS REFERENCE CHART

You can look at the figure number of the valve on the line and by referring to the Chart tell quickly the exact OIC Valve to order to replace it. To reserve your copy, write to:

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OIC

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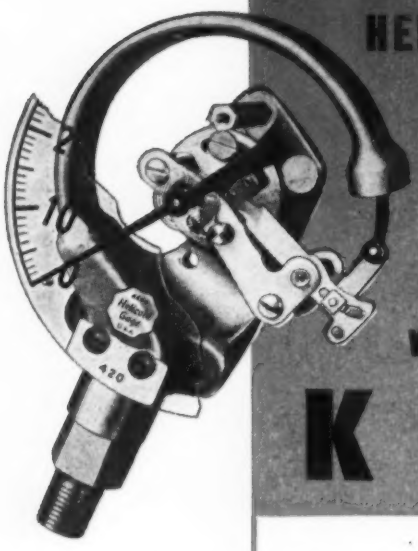
VALVES

STEEL-IRON-BRONZE



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FIRST

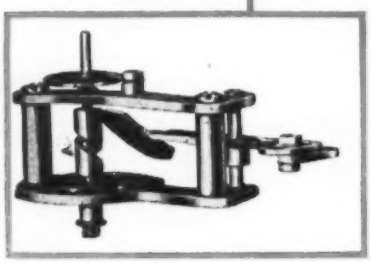
with Bourdon Tube of

K MONEL

With superior spring characteristics and high resistance to corrosion, K Monel is unequalled for certain difficult pressure gage applications. In actual service under the worst corrosive conditions, such as Hydrogen Sulphide gas or oil, Helicoid Pressure Gages with K Monel Bourdon Tubes have remained accurate ten times longer than gages with stainless steel tubes.

K Monel Bourdon tubes are made of Korex tubing, with extra-smooth inside wall, for all pressures from 30 p.s.i. to 10,000 p.s.i.

- **These tubes are fused** to forged Monel sockets and tips—no solder, no welding rod—providing an integral Monel system. Heat-treated to obtain maximum spring properties in tube.
- **K Monel Gages cost no more** than stainless steel tube gages. Yet they are infinitely superior for prolonged accuracy and low hysteresis effect.
- **Try Helicoid Gages now** with K Monel tubes. Send for your copy of the new Helicoid Gage catalog.



The Helicoid Movement is one of many exclusive features of the Helicoid Pressure Gage.

ACCO

HELICOID GAGE DIVISION

AMERICAN CHAIN & CABLE

Bridgeport 2, Connecticut

TRADE MARK

tendent and William G Godfrey becomes assistant superintendent. Franklin E Brown has been made resident manager of Genesee district.

Joy Mfg Co elected E M Platts vice-president in charge of sales.

Ralph Riker has been made manager of sales promotion and merchandising of **Gillespie Varnish Co.**

Jack P Lewis has been appointed director of engineering of **Connecticut Power Co,** with headquarters in New London. Kenneth L Partridge has been named assistant superintendent of engineering.

Harold D Beebe has been made general superintendent of **Tampa Electric Co.** J D Hicks succeeds Beebe as transmission superintendent.

Puget Sound Power & Light Co has promoted L E Karrer to executive vice-president. Howard G Carter has been named superintendent of light and power for the western div at Bremerton to replace the late A M McDonald.

T R Roach has been elected executive vice-president and general manager of **Idaho Power Co,** with headquarters at Boise.

Pacific Power & Light Co has elected John Dierdorff vice-president. Reorganization changes in personnel as a result of merger of Pacific Power & Light Co and Northwestern Electric Co include appointment of E F Pearson as assistant general manager of Northwestern div of PP&L, in charge of the company's operations in Portland and Ranier, Ore., and Vancouver and Camas, Wash. Other new assignments include: (1) Cecil A Root has been promoted to Vancouver district manager. (2) J C Plankinton has been named assistant to vice-president in rates and research dept. (3) H H Schoolfield was made chief engineer of the combined companies. (4) O L LeFever was named assistant chief engineer of Pacific. (5) D R McClung became Pacific's general superintendent. (6) Tom Perry was made superintendent of Northwestern div.

W Robert Moore is now associated with H Edward Gross Co, Stock Exchange Bldg, Philadelphia, as partner.

George H Woodard has entered consulting practice with **Charles H Welling & Co,** 52 Vanderbilt Ave, New York City. Woodard will serve manufacturers interested in development of new product lines.

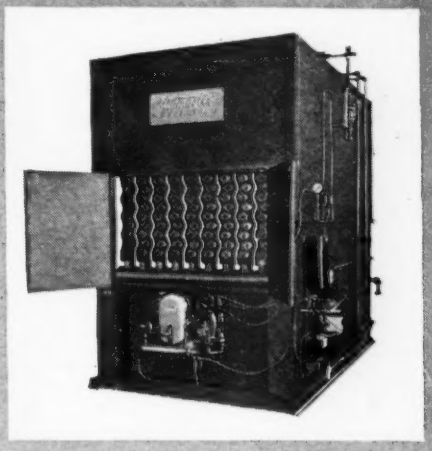
American Society of Mechanical Engineers has named E G Bailey as its president for the year 1947-1948. Bailey has been a vice-president and director of Babcock & Wilcox Co since 1930.

Robert D Martin, assistant vice-president of New York Steam Corp, succeeds John F Malone as president of **National District Heating Assn.** Other officers elected are Henry L Martin of Boston Edison Co, Boston, Mass., first vice-president; David

Power Engineers Agree: It's the GUTS that make a GOOD BOILER

STEAMASTER Builds Boilers with PLENTY of GUTS!

In design, construction and materials, Steamaster builds boilers with the guts to give reliable, efficient performance year in and year out.



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The GUTS of the Steamaster Boiler

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Inclined Tubes

Sectional Steel Headers

Longitudinal Drum

In every industry where high pressure boilers are used you will find Steamaster Automatic Boilers giving consistently excellent performance at low cost.

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Quick Facts About the Advantages of the STEAMASTER Water Tube Boiler:

- **All Steel Construction.**
- **Positive Tidal Circulation of Water**—maintains all parts at equal temperature.
- **Condensate Return System Built-in** as an integral part of all boilers of 60 h.p. and up.
- **Fabricated Entirely in Our Own Plant.**
- **Easy Inspection and Maintenance**—every tube immediately accessible. Just open the heavily insulated access doors.
- **Large Combustion Area . . . Three-Pass Heat Baffling** gives high thermal efficiency.
- **Choice of Fuel — Gas, Oil or Coal** or any combination of these fuels to meet fuel requirements of your plant.
- **Fully Equipped for Automatic Operation**—with the finest accessories. As nearly automatic as a boiler can be.
- **A.S.M.E. CODE — National Board Approved.** Inspected and certified by Hartford Steam Boiler Inspection and Insurance Co.
- **Full Range of Sizes** from 10 h.p. to 300 h.p. as illustrated. The Model A for 3½ h.p., 5 h.p. and 7½ h.p.
- **Can Be Fired Over Rated Capacity** and still maintain high thermal efficiency.

Power Engineers Agree: STEAMASTER is the Boiler with PLENTY OF GUTS!

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APPLICATIONS: Temperature control for thermostatic water heaters, converters, cookers, plating tanks, open and closed processing tanks, sterilizers and fuel oil preheaters.

Sizes from ½" to 1½" inc.
For steam pressures to 150 lbs. per square inch.
Standard temperature range 130° F to 190° F.
Other ranges available from 80° F to 250° F.

★ **Easy to install**—Requires minimum space—suitable for marine service.

★ **Simple to adjust**—Increase or decrease spring tension to change temperature over a 60° F. range. Self-contained bellows and bulb assembly can be serviced without changing valve stem adjustment or breaking pipe connections.

★ **Is self-motivated**—Requires no external source of power, such as electric current, air or water pressure for operation.

★ **Dependable accuracy**—Fitted with hydraulically formed bellows of selected material for endurance and proper response to the expandable fluid in the bulb to maintain correct temperatures.

★ Again, Hoffman provides *one dependable source of supply* . . . one over-all guarantee of fine quality, in Controls for Industry. Write for Series 1100 Bulletin, no obligation.

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W Loucks of Allegheny County Steam Heating Co, Pittsburgh, Pa., second vice-president; and George H Tuttle of Detroit Edison Co, third vice-president.

D S Walker, vice-president of Combustion Engrg Co, New York City, was elected president of **U. S. Naval Academy Alumni Assn** at a recent meeting of board of trustees at Annapolis, Md.

American Society of Lubricating Engineers has elected Wilbur Deutsch, of Brooks Equipment Co, chairman of a newly formed northern California section. H G Isbell was chosen vice-chairman and L W McLennan, secretary-treasurer.

National Assn of Power Engineers, Utah No. 1, elected James C Madsen president. Madsen succeeds Wiley L Ludwig. D W Thompson was chosen vice-president; Richard F Taylor, corresponding secretary; Clifford Smith, recording secretary; Joseph S Durant, treasurer; and J P Quigley financial secretary.

Frank R Eck has been elected president of Indianapolis chapter of **National Assn of Power Engineers.** Other officers installed include Jess Amon, vice-president; Henry Peters, recording secretary; Fred Siefker, financial secretary; Joseph Meakin, corresponding secretary; Frank Sigafoos, treasurer; and Ignatz Galdus, conductor.

Electric City Chapter 37, **National Assn of Power Engineers,** held its annual meeting in Niagara Falls and elected following officers: James Witherow, president; John Donald, vice-president; Charles F Banks, treasurer; Richard McGrath, recording secretary; Clifford Abray, financial secretary; Royce Syphrit, doorkeeper; William Everett, conductor; Russell Lichard, corresponding secretary.

Federal Power Commission elected Harrington Wimberly vice-chairman, succeeding Richard Sachse who resigned because of ill health.

Simon H Ingberg retired as chief of fire resistance section of **National Bureau of Standards.**

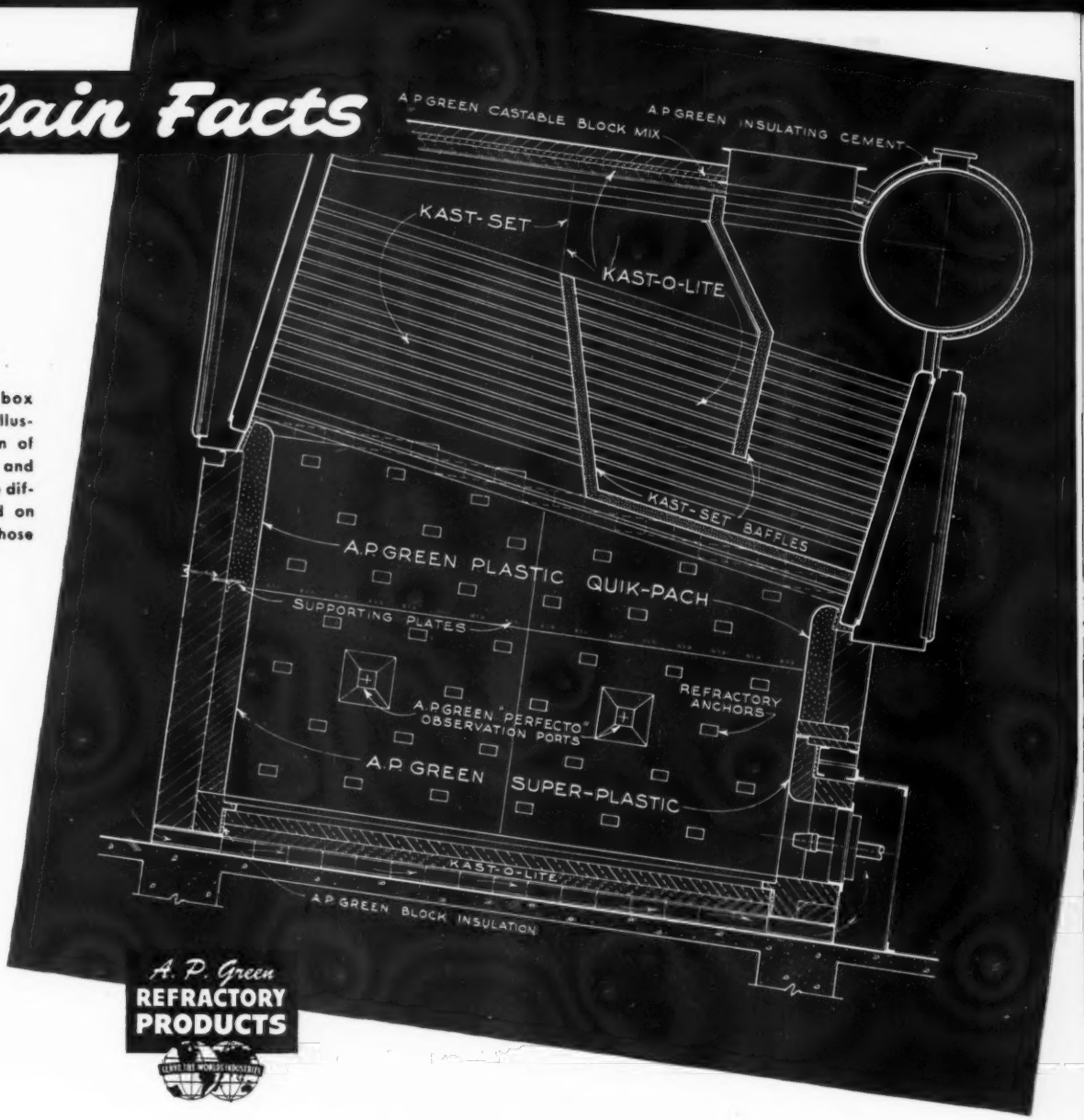
H F Mullikin has been appointed head of dept of mechanical engineering at **Montana State College,** Bozeman, Mont.

Carnegie Institute of Technology has appointed Dr Douglas F Miner director of student personnel and welfare div. Dr Miner succeeds Dr B E Warden, who resigned.

C Richard Soderberg has been appointed head of mechanical engineering dept at **Massachusetts Institute of Technology,** succeeding Dr Jerome C Hunsaker, who will devote his entire attention at the Institute to heading the dept of aeronautical engineering.

American Institute of Physics has elected Cleveland Norcross assistant director.

Just Plain Facts



Typical cross-drum box header type boiler illustrating the application of A. P. Green's plastic and castable refractories to different sections, based on service conditions in those zones.

Advantages of A. P. Green plastic firebrick

Successful refractory installations must meet the varying service conditions in different sections of industrial heating and power units. It is both practical and economical to install a specific material to meet the condition in each section or zone. A. P. Green produces plastic and castable refractories "zone rated" to serve this purpose.

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SUPER-PLASTIC is well above the American Society for Testing Materials requirements for Super Duty Plastic Refractories (C176-44). It is recommended in zones where conditions are most severe.

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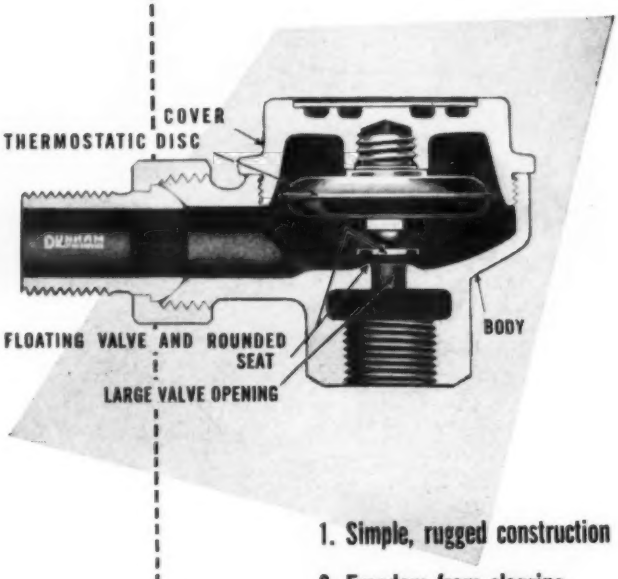

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OBITUARIES

W T Jones, treasurer of Barnes & Jones, Inc, Boston, Mass., died of a heart attack on July 19. He served as president of American Society of Heating and Ventilating Engineers in 1933, first vice-president in 1932 and second vice-president in 1931.

Gustavus W Carter, 79, retired chief engineer of Quincy (Mass.) Electric Light & Power Co, died at Quincy on June 25.

James F Pratt, 68, for past 16 years an operating engineer with Essex Tanning Co, Salem, Mass., died on July 3.

Howard S Denham, 65, a heating and ventilating engineer, died on June 30 at Boston, Mass. During World War II he was employed by Stone & Webster Engrg Corp, Boston, and received a citation from the government for his work in atomic bomb development.

Frank Victor Stone, 73, for many years associated with Bay State Pump Co, South Boston, Mass., died at Newton Highlands, Mass., on June 30. He had retired from active business.

Walter Belding, superintendent of construction for Central Vermont Public Service Corp, died at Rutland, Vt., on June 15 after a long illness.

Frank J Yerger, 73, a stationary engineer for many years at Nathaniel Hawthorne School 25 in Rochester, N. Y., and various high schools throughout that city, died recently at his home after a long illness.

Harry A Maurer, 70, former general superintendent, director and secretary of Oster Mfg Co, Cleveland, Ohio, died on June 17 after an illness of several months.

J C Munro, 54, manager of general sales div, B. C. Electric Railway Co, Vancouver, B. C., Canada died recently after a month's illness.

Leslie Standish Hall, 55, principal hydraulic engineer for East Bay Municipal Utilities District, died in Oakland, Calif., on July 5.

William J Smith, 74, stationary engineer of Knowlton Brothers, Inc, Watertown, N. Y., died recently of heart disease in engine room of the plant. He had been with the company for 30 years.

Herman Kamholz, engineer at Asylum of Our Lady of Refuge, Buffalo, N. Y., died in a hospital after a long illness. He was the holder of one of the oldest licenses issued to a stationary engineer by city of Buffalo.

George J Schimley Sr, 83, for 18 years a stationary engineer for Le Roy Lime & Crushed Stone Co, Le Roy, N. Y., died recently in Buffalo of a heart attack.

James Edward Breach, 78, retired stationary engineer, died recently in General Hospital, Niagara Falls, Ont.

Michael D Martin, chief engineer at Hotel Syracuse, Syracuse, N. Y., died recently at his home.

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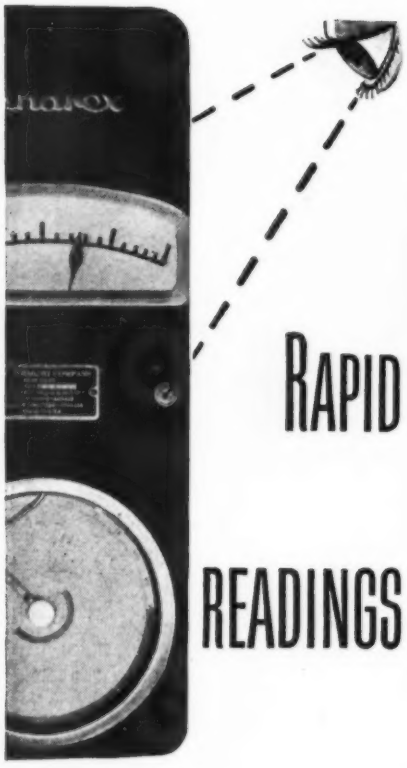

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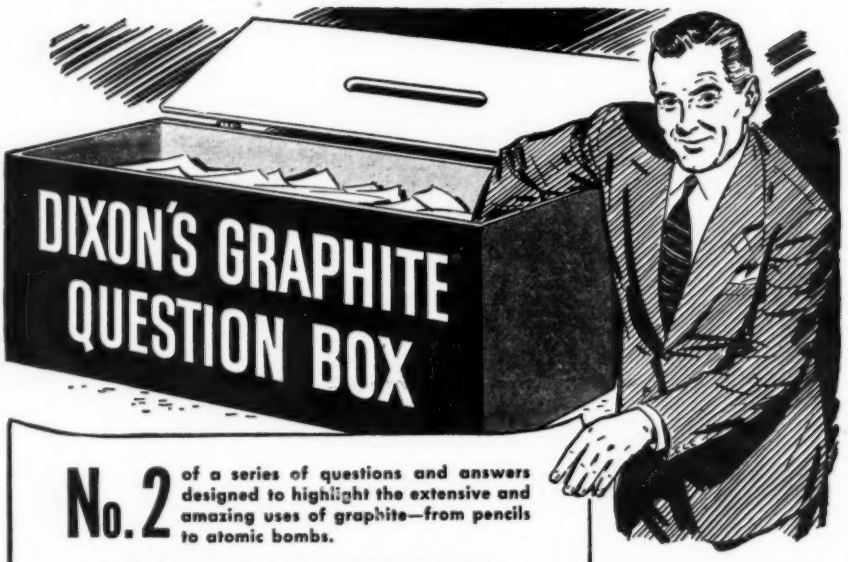

No. 2 of a series of questions and answers designed to highlight the extensive and amazing uses of graphite—from pencils to atomic bombs.

SOURCE AND PROPERTIES OF GRAPHITE

QUES. Are all graphites—varying in type, purity and particle size—suitable for the same uses?

ANS. Definitely not. In nearly every case, each application governs the selection of graphite in type, purity and particle size. Lubricants require the crystalline types of highest purity. Electrical applications usually require high purity. The lower purity grades of natural amorphous graphites find less exacting uses.

QUES. What are the characteristics of graphite that make it one of mankind's most useful industrial minerals?

ANS. It is extremely lubricous or slippery, lustrous, oil-and-grease-free (unless processed with such), and withstands excessive heat, cold and pressures. It neither destroys nor is destroyed by contact with water, oil or any chemical. It is electrically conductive, heat conductive, non-magnetic, non-fusible, non-toxic, non-odorous and does not permanently stain. It adheres tenaciously to almost all substances and has a low co-efficient of expansion.

QUES. What was the first product made from graphite?

ANS. Pencils, in 1554.

QUES. Is graphite processed into all required forms and shapes that make it usable for innumerable manual, mechanical, chemical, and electrical applications?

ANS. Graphite owes its remarkable versatility to its almost unlimited scope of form and formulation. It is available in a wide variety of microscopic powders, large flakes, fluids, non-fluids, concentrates, bars, tubes, sheets, plates and specially processed shapes.

QUES. In what products or processes is graphite now principally used?

ANS. Lubricants • Pipe joint seals • Mechanical packings • Gaskets • Brake linings • Sand and metallic molds • Lustrous heat-resisting polishes • Protective coatings • Crucibles and refractories • Electronics • Electroplating • Electrodes • Dry batteries • Motor and generator brushes.

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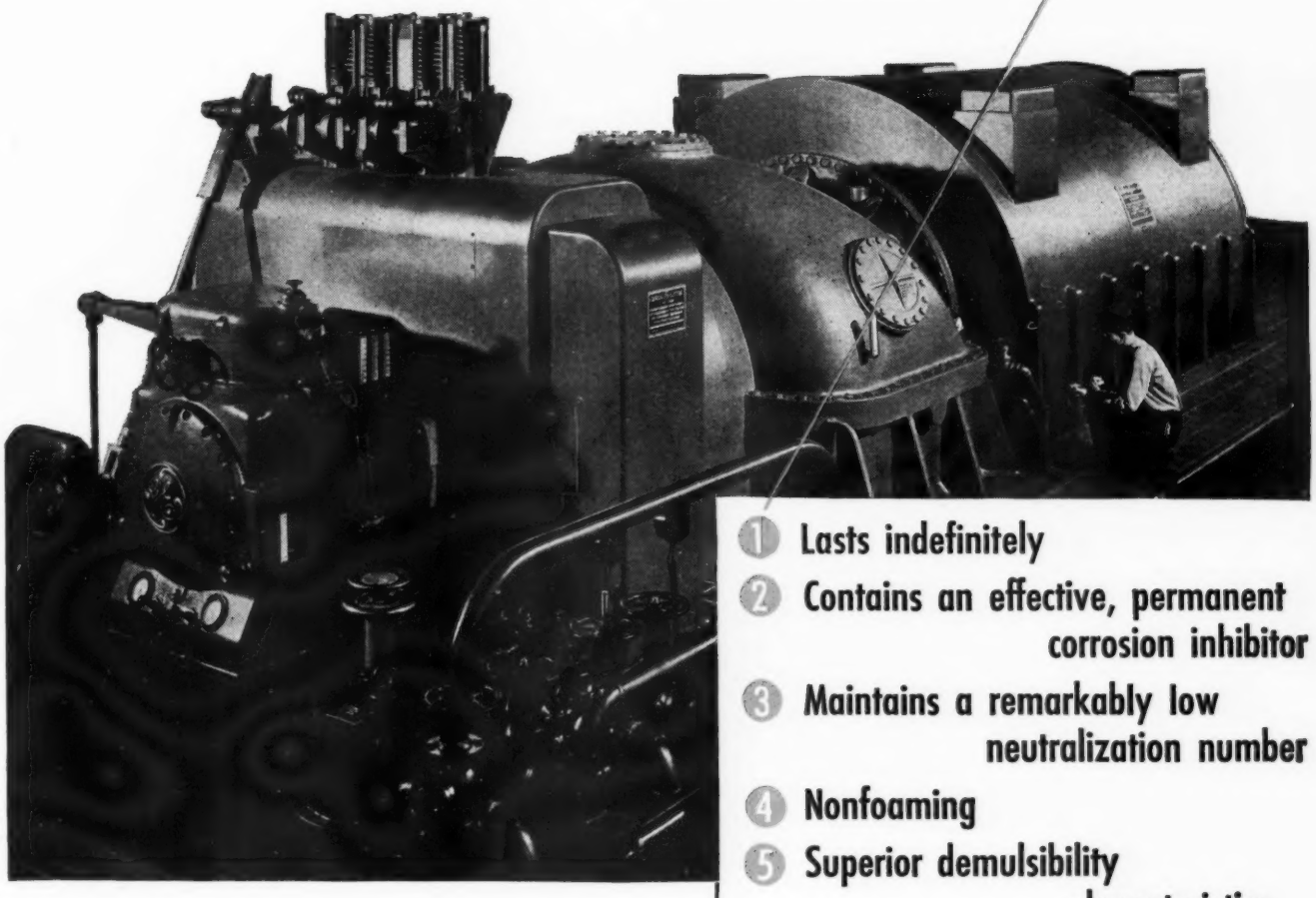

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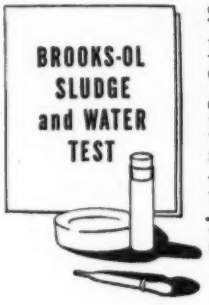

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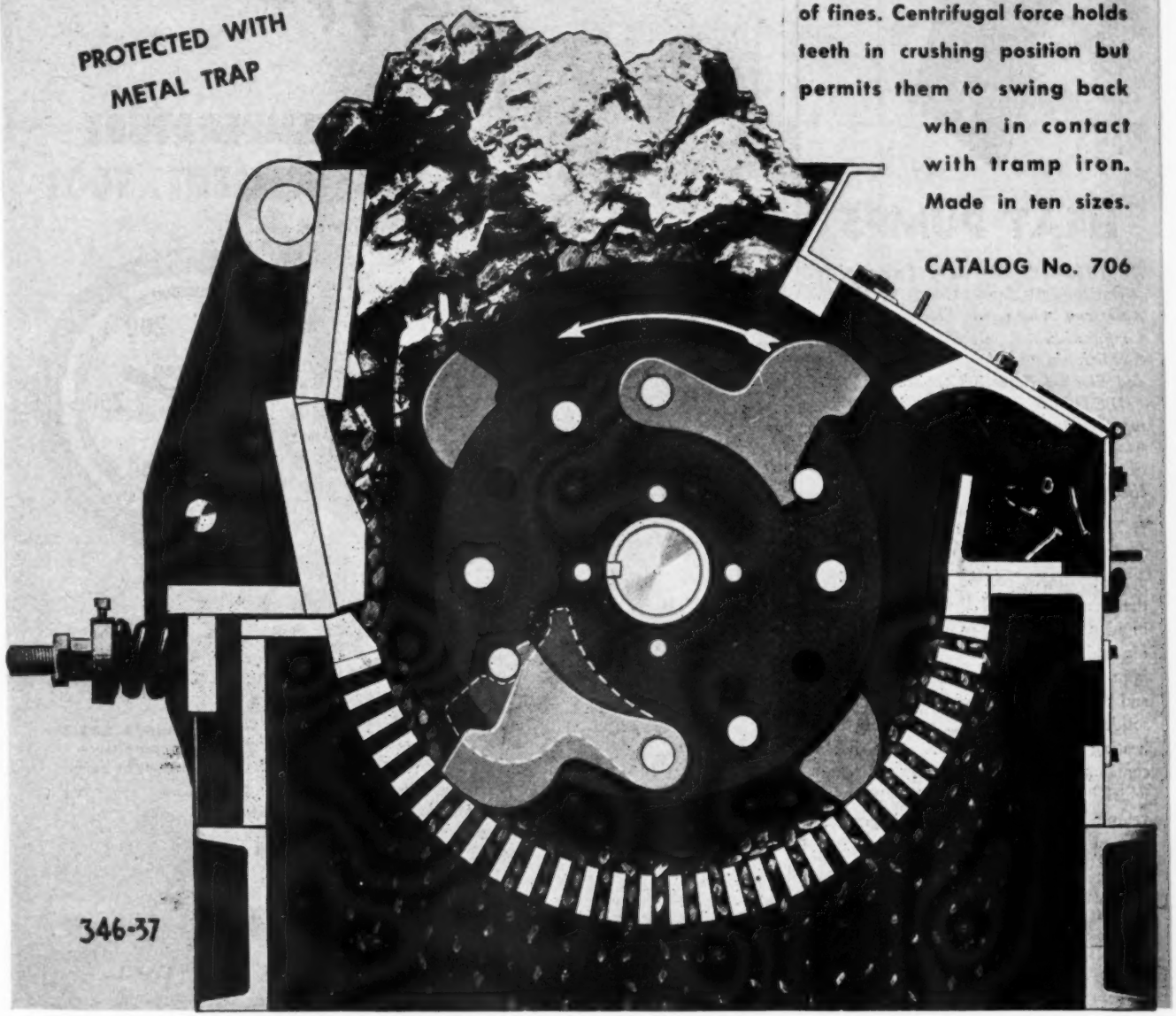

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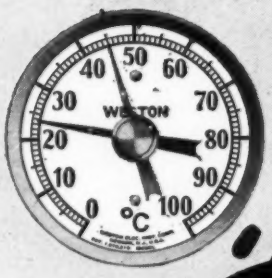

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Shows high or low temperatures reached since last setting

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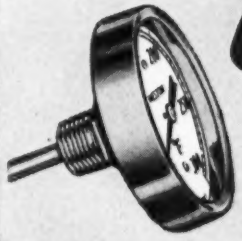
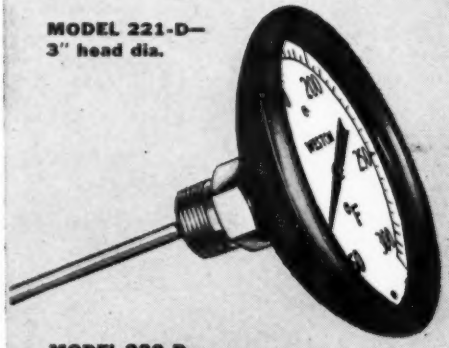
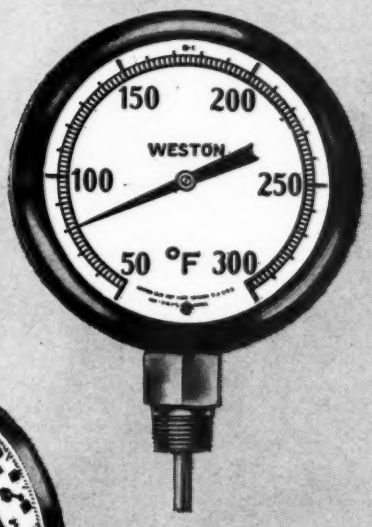


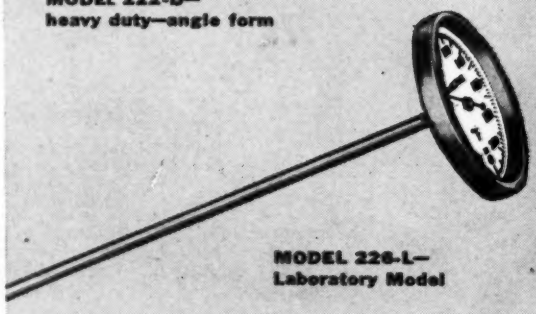
MODEL 221-D—
3" head dia.



MODEL 222-D—
heavy duty—angle form



MODEL 122-D—
heavy duty—straight form



MODEL 226-L—
Laboratory Model

In temperature measurement, too, WESTON leads the way! The sturdy, all-metal construction of these WESTON thermometers, plus their simplicity of design, materially reduces thermometer breakage and maintenance, and safeguards their high initial accuracy over long periods of time. Available in sizes, types and stem lengths for most applications. For information on the complete line see your jobber, or local WESTON representative. Weston Electrical Instrument Corporation, 617 Frelinghuysen Ave., Newark 5, N. J.

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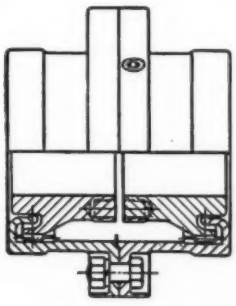
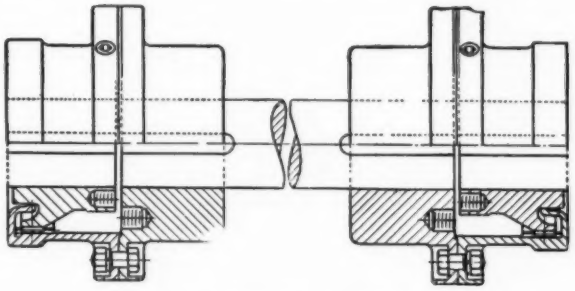
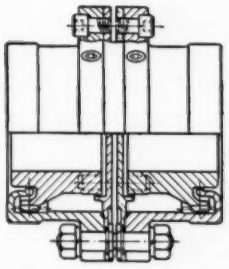
ROCHESTER · SAN FRANCISCO · SEATTLE · ST. LOUIS · SYRACUSE · IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.



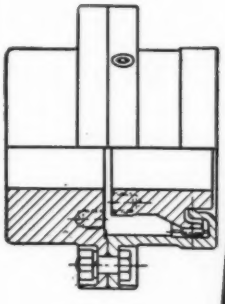
STANDARD



FLOATING SHAFT



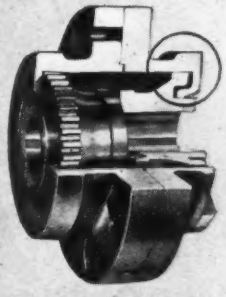
BREAKING PIN



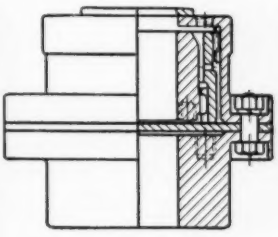
SINGLE ENGAGEMENT

WHATEVER YOUR CHOICE . . .

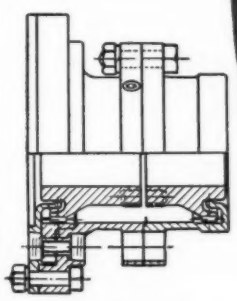
FAST'S GIVES YOU THIS EXTRA SAFEGUARD!



ALL - STEEL CONSTRUCTION! NO PERISHABLE PARTS! Those statements apply to Fast's self-aligning couplings — uniquely designed to give you uninterrupted power transmission. The *exclusive* "rocking bearing" (circled) is an example of Fast's thoroughness. It provides a positive metal-to-metal seal for the load-carrying oil, permanently protecting it against moisture, dust and grit. No perishable packing rings are used. There's nothing to wear, nothing to fail. ¶ Years of engineering experience, Koppers' high standard of workmanship and unexcelled coupling service pay off in longer machine life, lower upkeep costs and minimum shutdown losses . . . when you choose your Couplings from Fast's big, complete line. Prompt delivery. Write for our catalog to: Koppers Co., Inc., Fast's Coupling Dept., 249 Scott St., Baltimore 3, Md.



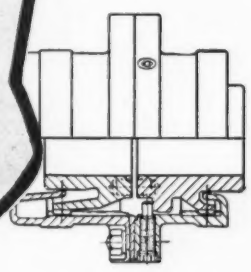
VERTICAL



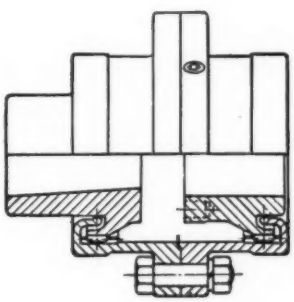
SHEAR PIN

K KOPPERS

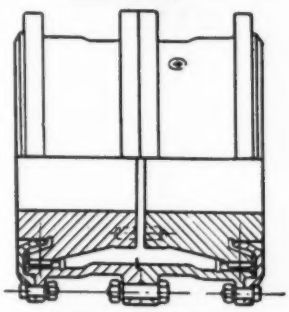
FAST'S *self-aligning* **COUPLINGS**



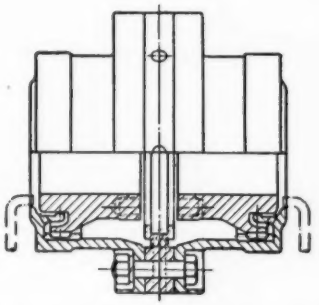
CUT-OUT



MILL MOTOR



HEAVY DUTY



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Linings for

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They are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

Write for Bulletin

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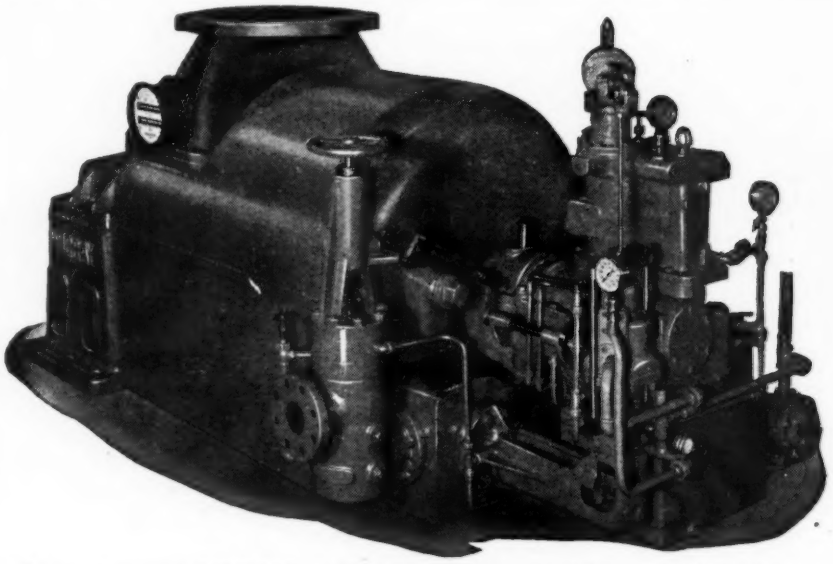

One of two MURRAY multistage steam turbines, designed to deliver 685 horsepower on steam at 110 pounds and exhausting to 26½ inches Hg vacuum, furnished to drive high speed centrifugal compressors for refrigeration in one of the most prominent Southern Hotels. A third unit has recently been shipped. Equipment includes variable speed oil relay governor, trip and throttle valve, strainer surrounding the double seated balanced governor valve, and force feed lubrication.

MURRAY
MULTISTAGE STEAM TURBINES

★ ★ ★ ★

The complete MURRAY line of steam turbines includes all variations of mechanical drives, and turbine generator sets up to and including 3000 KW rating.

Sales Representatives for Murray products are located in all principal cities.

MURRAY IRON WORKS COMPANY

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Builders of steam Power Equipment for Three Quarters of a Century

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SUBSIDIARY OF THE DOW CHEMICAL COMPANY

need more water?

Increase water well production—the chemical way!

The record speaks for itself. Treatment results in Dowell files list the many production increases which have been secured through the proper chemical treatment of water wells.

The chemical removal of retarding incrustations on screens, tubing and pump equipment and the enlargement of formation pores permit the production of more water—faster!

Dowell pioneered the well-acidizing field and its engineers have the know-how based on years of experience gained in treating thousands of oil, gas and water wells. Call the nearest Dowell office for a free estimate. Ask also about Dowell chemical scale removal service for water lines, steam generating and heat exchange equipment.

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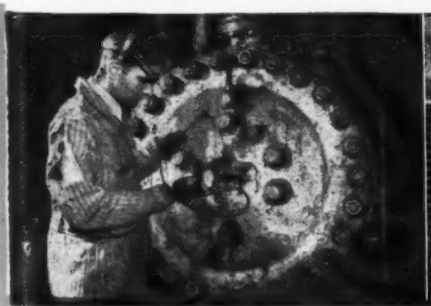
New York, Philadelphia, Boston, Baltimore, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Kansas City, Wichita, Oklahoma City, Houston, Fort Worth, Shreveport, Mt. Pleasant, Michigan; Salem, Ill.; Borger, Texas; Wichita Falls, Texas; Midland, Texas; Lafayette, La. Long Beach, Casper: Dowell Associate—International Cementers, Inc.

Dowell's industrial engineers are selected for experience and ability—trained in the field and in the laboratory. Dowell's field equipment is scientifically designed to control, step-by-step, the complete scale removal process. Solvents are chosen and mixed to fit each individual job.

FREE SHOWING! *New 18-minute sound slide film illustrating the possibilities of Dowell Chemical Scale Removal Service. To arrange a special showing call or write Dowell.*



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With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

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New Bedford, Mass.

TO HELP YOU WITH FUTURE POWER PLANNING

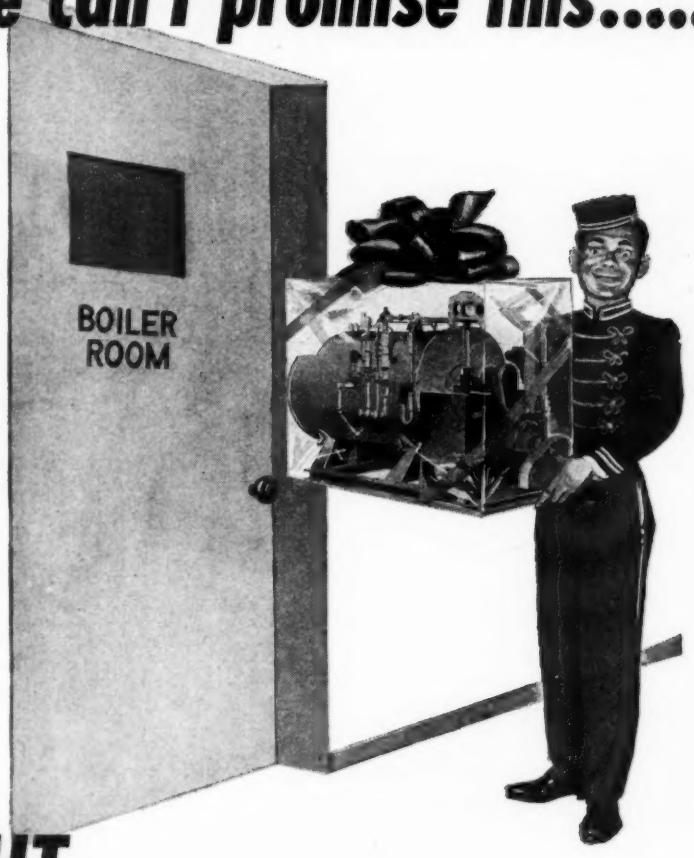
Special section on

"METALS FOR HIGH-TEMPERATURE SERVICE"

OCTOBER—POWER

16 pages summarizing the latest developments in this field.

We can't promise this.....



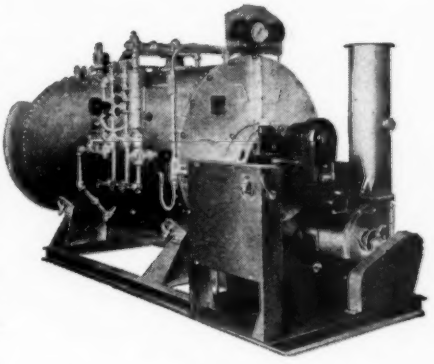
BUT.....

Even though it's "slightly" more than messenger-boy size, the portable, space-saving Preferred Unit Steam Generator still makes a compact package. Designed with minimum floor and head room requirements, it fits into half the space needed for many boilers of equivalent output.

When a Preferred Unit is delivered to your plant, it comes fully equipped . . . piped, wired, and mounted on a heavy H-beam steel base. No special foundation required. No need to build expensive stacks. Just a few simple connections and you have a completely self-contained power plant all set to start generating steam . . . rapidly and economically.

The modern Preferred Unit Steam Generator is a fully automatic "packaged" steam generator with a minimum thermal efficiency of 80%. Each unit is fired and tested prior to shipment and is properly adjusted for its rated capacity.

SIZES: Preferred Units are available in a full range of sizes from 40 to 500 H.P. and pressures 15



to 200 lbs. in the Four-Pass models; 10, 20 and 30 H.P. with pressures 15 to 125 lbs. in Two-Pass models.

Write for Bulletin 1000E giving the engineering details and "Dividends From Your Power Plant" telling the profit story about the Preferred Unit Steam Generator.

P-9-47

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Devoted to the Technical and Economic Problems in Piping

1109 CLARK BUILDING PITTSBURGH, PA.

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Removable Self-Starter Strip exposes ends of Labels for you to pull!
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FREE SAMPLES
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2 APPLY
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LIKEWISE ON FLAT SURFACES
*Patents Pending

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Manufacturers of Self-Sticking Tape Products
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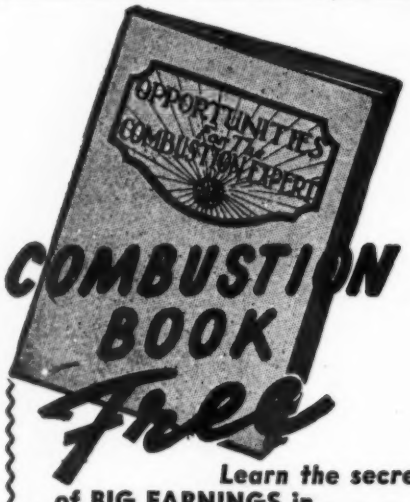

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There are plenty of good pay jobs in the power field today. Increase your earnings now—be a Hays-Trained Combustion Engineer. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

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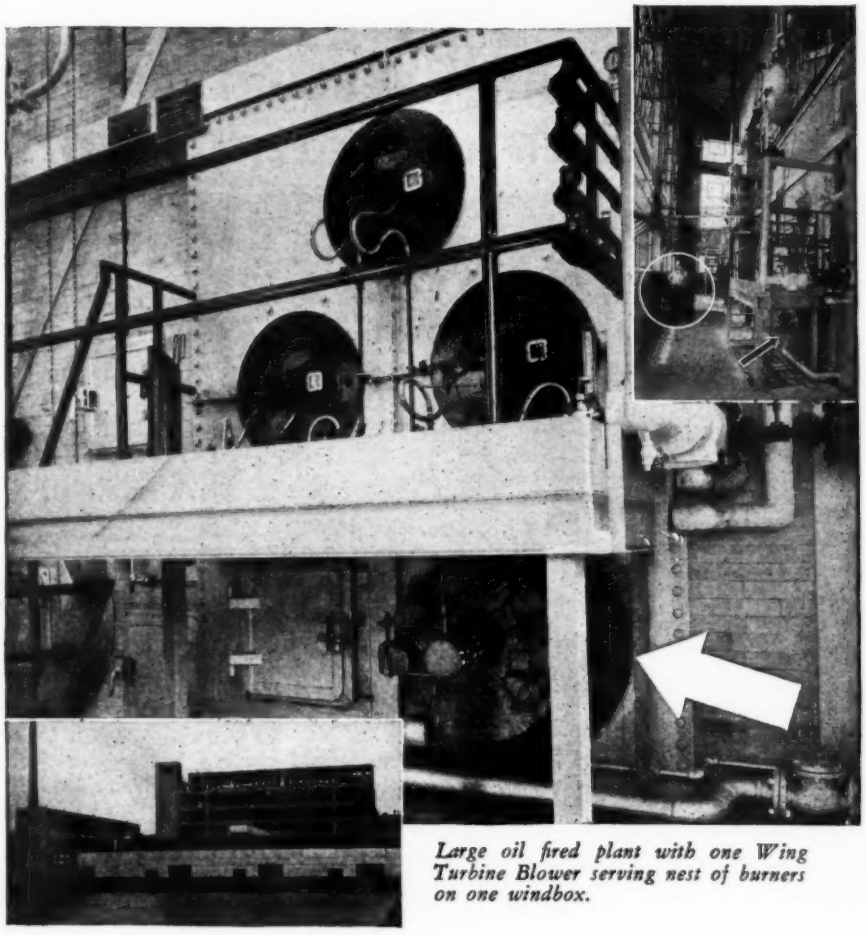


Large oil fired plant with one Wing Turbine Blower serving nest of burners on one windbox.

Wing Turbine Blowers Save:

POWER COSTS—because they can be installed on windboxes thereby eliminating duct losses requiring higher initial driving power.

ENGINEERING LAY-OUT TIME AND EXPENSE—because there are no ducts to design and find space for with their cumbersomeness and expense.

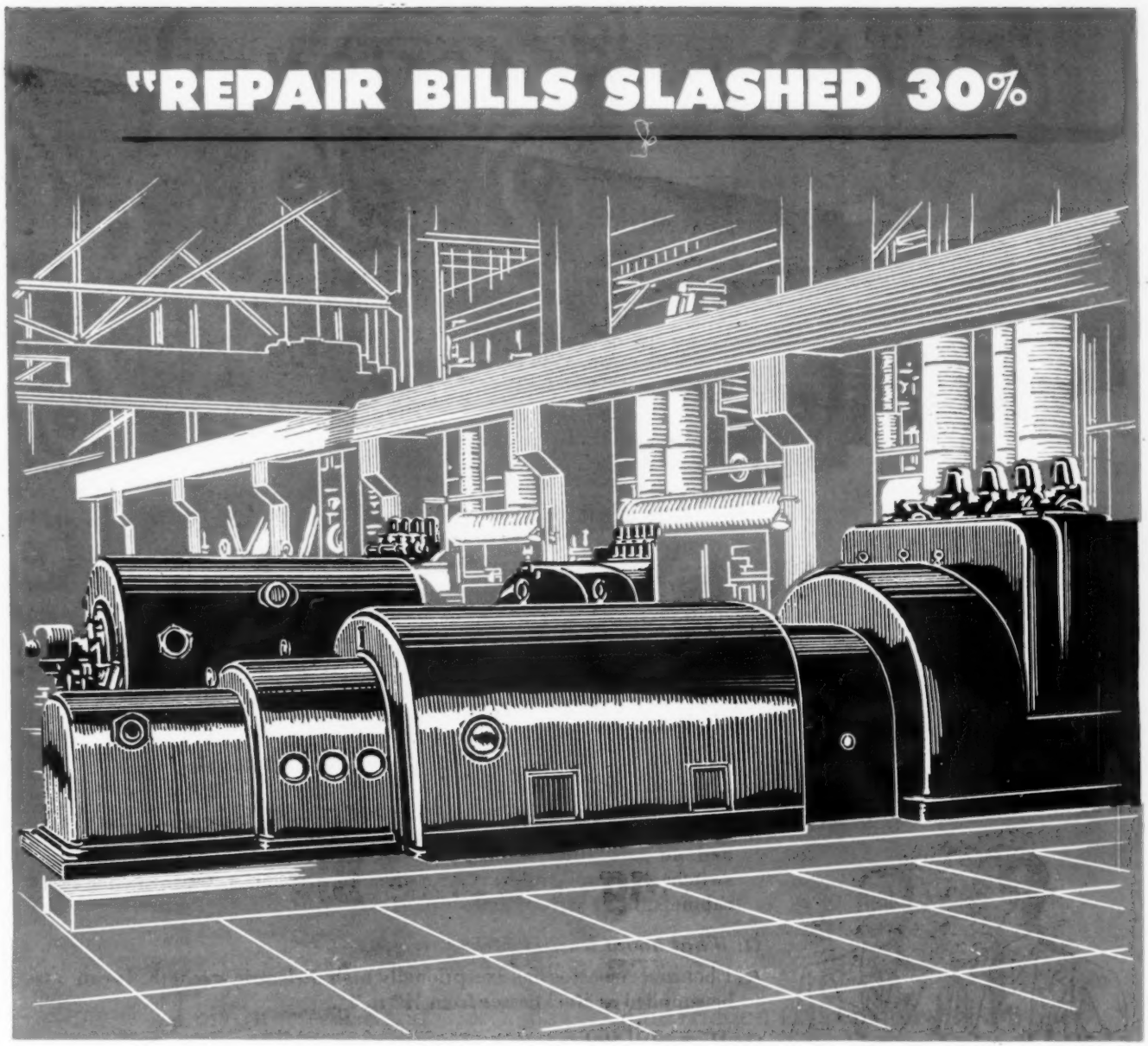
MAINTENANCE—because of their utter simplicity. An occasional shot of lubricant to the two ball bearings plus a very infrequent take-up on packing glands is all that is required of routine handling. There is no more rugged machine in any power plant than a Wing Blower.

Write for Bulletin SW-1

L. J. Wing Mfg. Co. 50 Seventh Ave., New York 11, N. Y.
Factories in Newark, N. J. and Montreal, Canada

TURBINE BLOWERS • TURBINES • WING • FANS • MOTOR DRIVEN BLOWERS
REVOLVING UNIT HEATERS • UTILITY HEATERS • FIXED DISCHARGE UNIT HEATERS
DUCT FANS • DRAFT INDUCERS • HEATER SECTIONS • SHIP VENTILATORS • FOG ELIMINATORS

"REPAIR BILLS SLASHED 30%



since using Tycol turbine oils"

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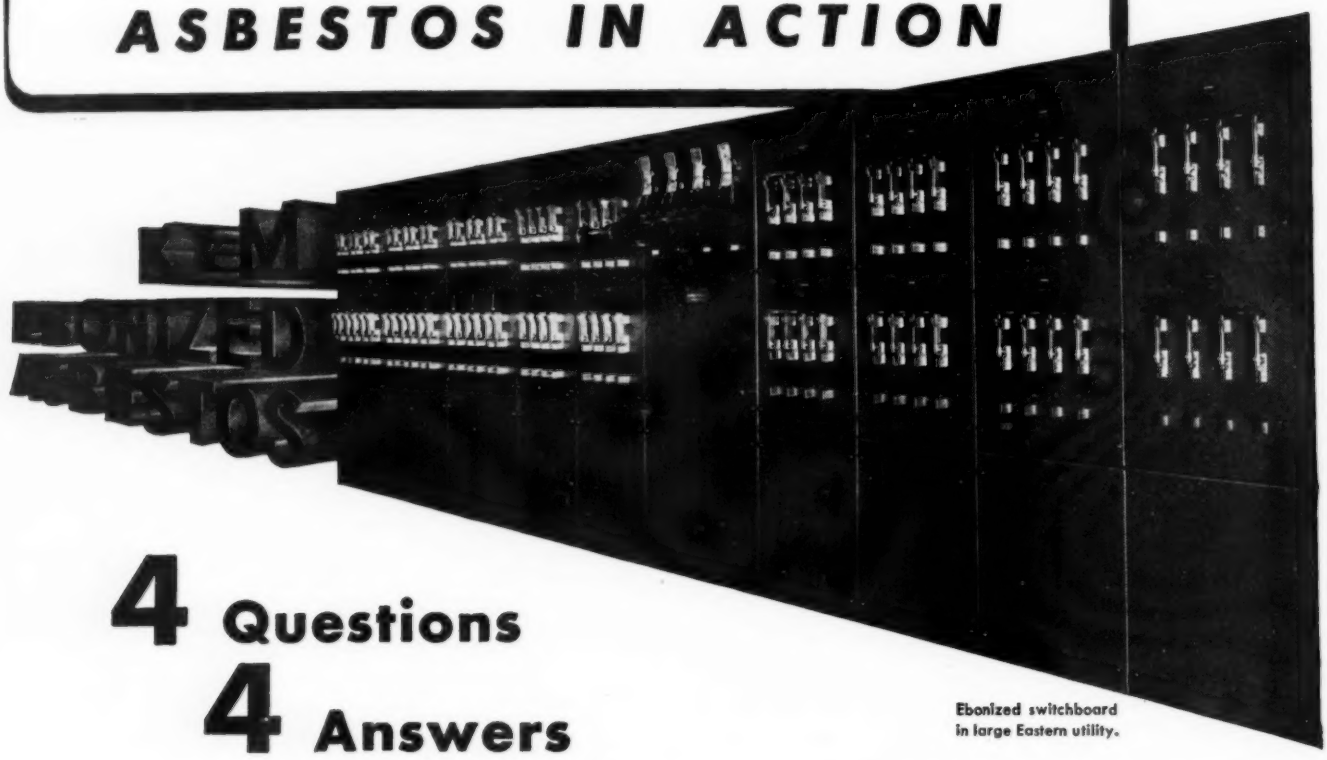
"Absolute absence of sludge . . .
Ten years without an oil change...
Bearings show no signs of wear . . .
Oil consumption cut in half . . ."

These results are typical of the excellent performances achieved with Tycol Turbine Oils. Refined by a special process, these modern lubricants stand up under the toughest service conditions . . . retain their original characteristics.

Call your nearest Tide Water Associated Office today for full information about the time- and money-saving advantages of Tycol Turbine Oils. Rust inhibited *Tycol RIO Turbine Oils* are also available for operations where corrosion may be a factor.

LUBRICATION—"ENGINEERED TO FIT THE JOB"

ASBESTOS IN ACTION



Ebonized switchboard in large Eastern utility.

4 Questions 4 Answers

TO HELP YOU SPECIFY YOUR ELECTRICAL MOUNTING MATERIAL

Q: ***What is Ebonized Asbestos?***

A: Ebonized Asbestos is a combination of asbestos fibres, a binder and an insulating compound—an ideal dielectric mounting for switches, controls, meters; for compartment linings, testing tables, cabinets, bus bar runs and supports.

Q: ***What about its dielectric strength?***

A: Ebonized Asbestos has exceptionally high dielectric strength. It can be supplied in thicknesses from ⅛" to 4".

Q: ***How about absorption of moisture and oil?***

A: Because of its composition, Ebonized Asbestos effectively resists the action of moisture and oil.

Q: ***Can it withstand shocks, vibration, rapid temperature changes?***

A: Absolutely. This is because Ebonized Asbestos is molded under tremendous hydraulic pressure into a dense, tough, monolithic sheet that possesses very high mechanical strength. Yet it is readily workable; can be drilled and machined as needed.

It will pay you to keep these points in mind when you lay out your next switchgear or control board jobs. If there are other facts you'd like to know about Ebonized Asbestos, we'll give your inquiries prompt attention.

Nature made Asbestos...

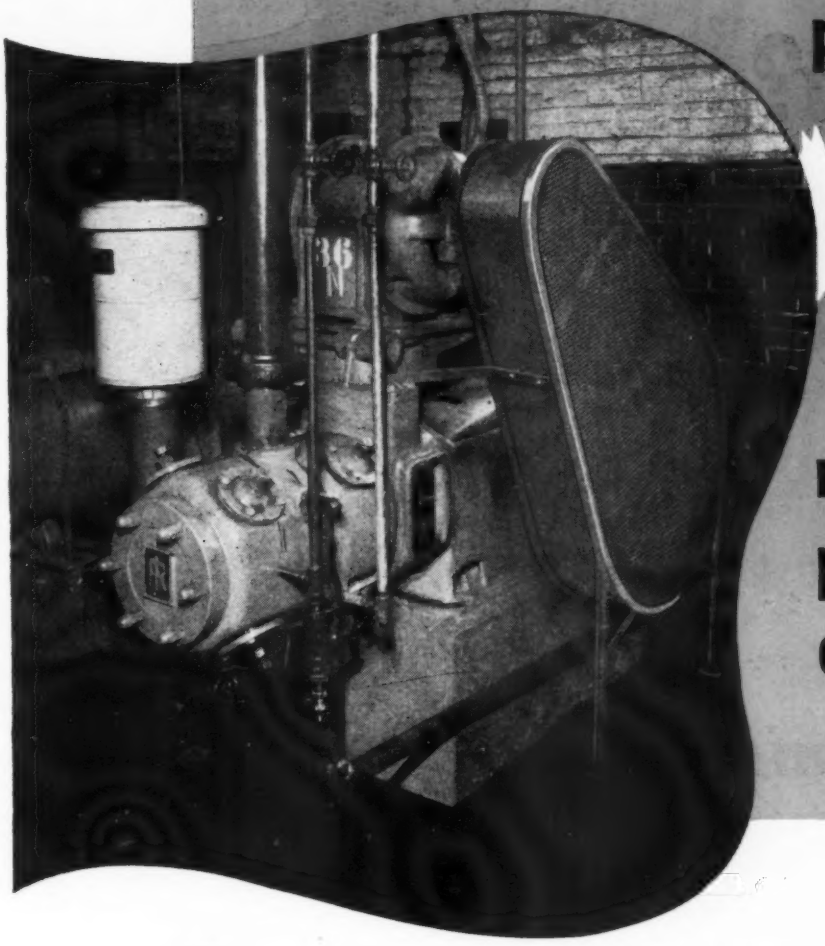
Keasbey & Mattison has made it serve mankind since 1873

K&M best in asbestos

Reg. U. S. Pat. Off.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
IN CANADA—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

Another Ingersoll-Rand ES Compressor proves that



Tapered Roller TIMKEN BEARING EQUIPPED

means anti-friction performance at its *Best*

This Ingersoll-Rand 7 x 7 ES Compressor is installed at the plant of a large bleaching, dyeing and finishing company to supply air for various purposes. It delivers 100 lb. pressure at 400 r.p.m.

Timken Tapered Roller Bearings are mounted on the crank shaft to (1) eliminate friction (2) promote smooth operation (3) carry radial, thrust and combined loads (4) prevent crank shaft wear (5) hold the crank shaft in correct and constant alignment.

Unless you get all of these advantages in the anti-frictionized compressor you buy you are not getting anti-friction efficiency *in full.* Make sure you have Timken Bearings in your compressors — with the trade-mark "TIMKEN" stamped on every cup and cone.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

which pump?

When you buy a pump you naturally expect good service, dependable operation, low power and maintenance costs and other benefits. The question is—which pump will give you these benefits in greater measure?

To help you answer this question read the clear statements about our Company and our products—draw your own conclusions.

1. Warren is backed by 50 years experience in building pumps.

2. Warren builds pumps *exclusively*. Our reputation is based *entirely* upon our ability to build pumps.

3. Warren builds practically *all types* of centrifugal and reciprocating pumps and will engineer special pumps for special purposes.

4. Warren ranks well among pump builders as to size, organization and facilities.

5. Warren bows to no one in selecting the right pump for the job. "A Warren recommendation is never a compromise."

6. Our customers include many of the famous names throughout industry.

7. Warren pumps are fairly priced—but not built to a price. Initial cost is insignificant when measured against results.

8. Warren pumps are guaranteed—not only as to quality and workmanship, but also for performance as rated when shipped. Maintained efficiency is inherent in every Warren design.

Why not put your pump problems up to Warren?

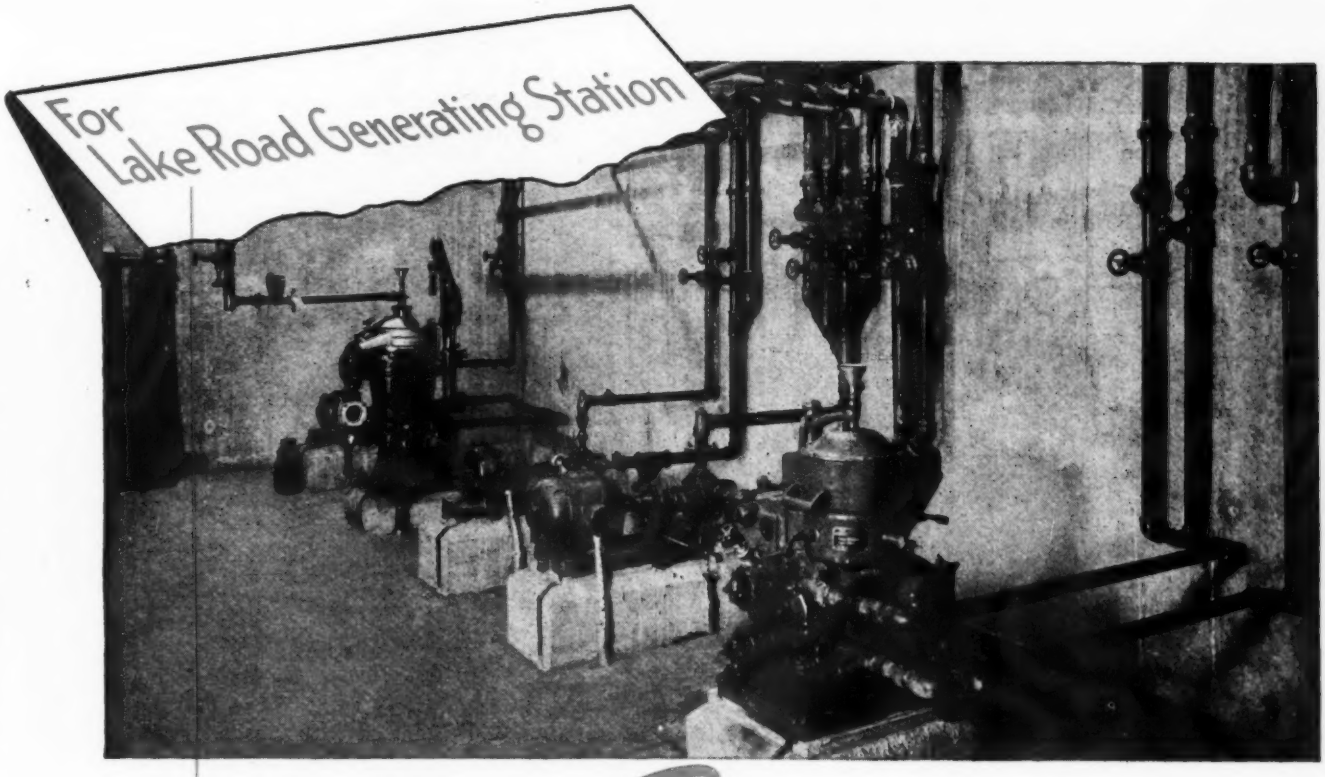
Our 50th Anniversary

WARREN PUMPS

Reciprocating and Centrifugal

WARREN STEAM PUMP CO., INC., WARREN, MASS.

Atlanta Boston Chicago Cleveland Denver Detroit Houston Manchester Los Angeles Minneapolis New Orleans New York Philadelphia Pittsburgh Richmond San Francisco Seattle St. Louis



Oil that is *Dry* and free from *Dirt*

AT Lake Road Generating Station, Cleveland, a De Laval "Unit-Matic" and another De Laval Oil Purifier keep the turbine oil in good condition. They remove ***both*** of the impurities that cause turbine oil to lose its lubricating effectiveness — ***dirt*** and ***water.***

Water is discharged continuously, immediately upon its removal from the oil by means of centrifugal force. It is impossible to prevent a certain amount of water from getting into a turbine lubricating system, but a De Laval Oil Purifier enables every operator to be ***sure*** that the water does not remain in the oil to accelerate the formation of sludge.

Wherever water removal is necessary to good lubricating oil performance, De Laval Oil Purifiers have another advantage — they have ample reserve capacity to remove an unexpected "slug" of water due to a sudden leak.

De Laval centrifugals in removing dirt from the oil store it out of the zone of purification. When it is so easy to get double protection for your turbine, why be satisfied with any less efficient means? Write for Bulletin TO-1.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval

LUBRICATING OIL PURIFIERS

Hundreds upon Hundreds used

throughout industry and on ships

Limitorque AUTOMATIC VALVE CONTROLS

Yes, "push button" operation of valves eliminates the slow, tiresome and frequently hazardous task (not to mention the valuable time of one or two men) of manual opening and closing. And, in addition to these advantages, the "Limitorque" Valve Control positively protects the valve stem, disc and seating rings from damage caused by foreign objects obstructing the closing of the valve, because the motor is *shut-off automatically* by the thrust exerted on the valve disc. . . . Then too, time is saved by the much speedier opening and closing of valve.

Limitorques are used on plug, cock, gate or globe valves—for Steam, Water, Gas, Oil, Air and Process Fluids. They are self-contained units and are mounted on top of valve yoke . . . no extra gears, nuts or bearings are required and all clutches and connecting sleeves are eliminated.

Send for latest Limitorque Valve Catalog, and be sure to use your Business Letterhead when writing.

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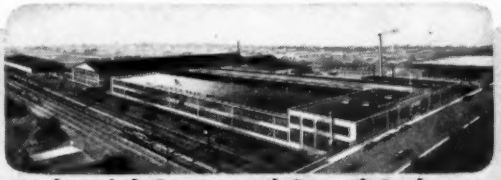
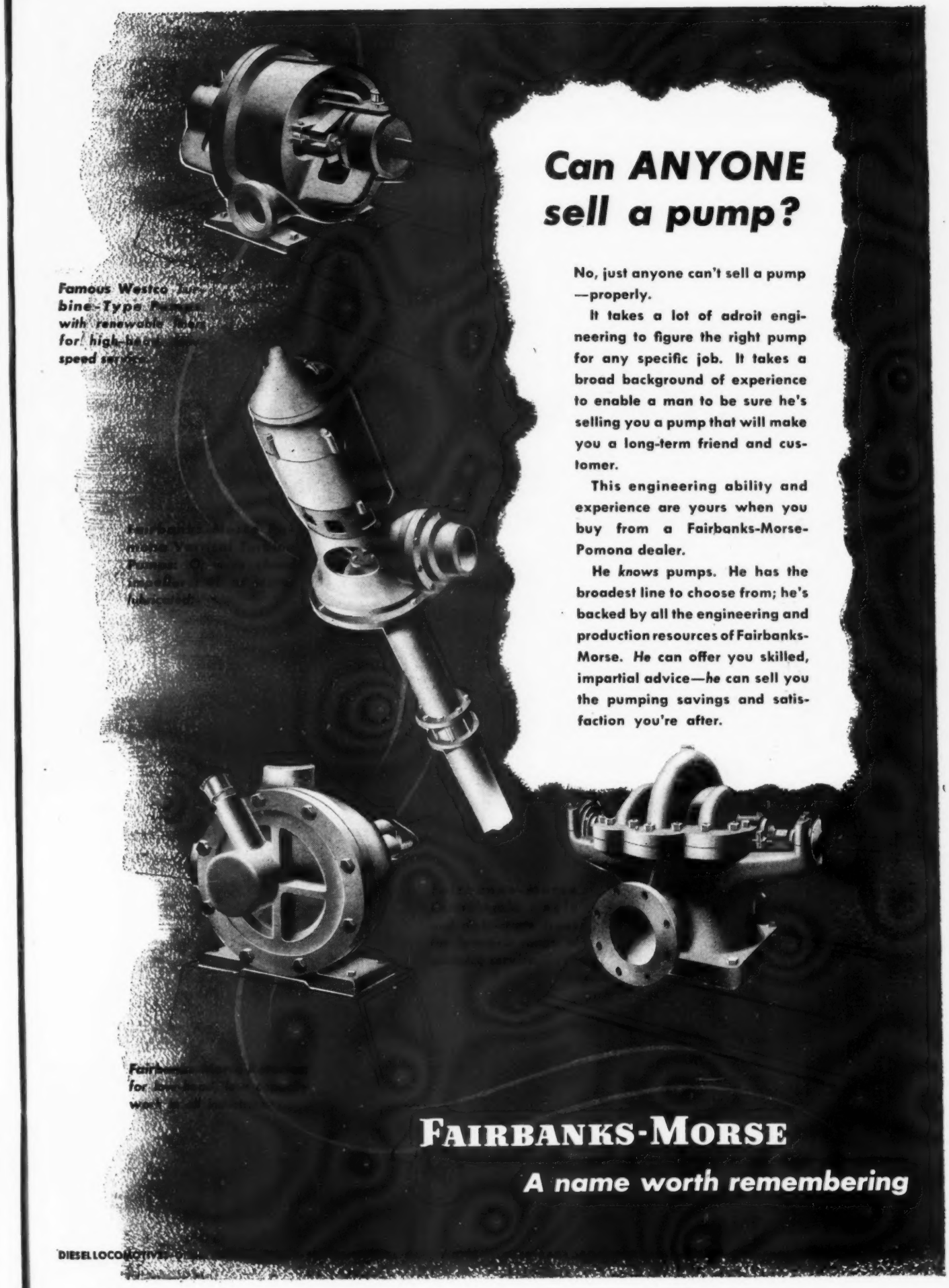
NEW YORK • PITTSBURGH • CHICAGO . . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls


Famous Westco
bine-Type
with renewable
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Pumps
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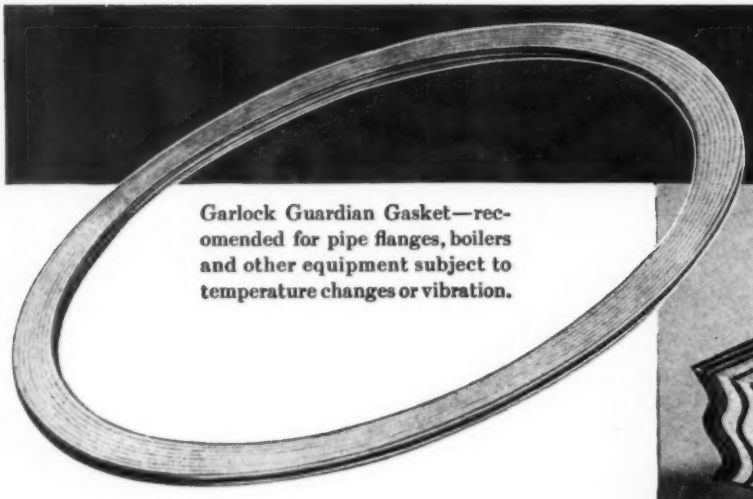
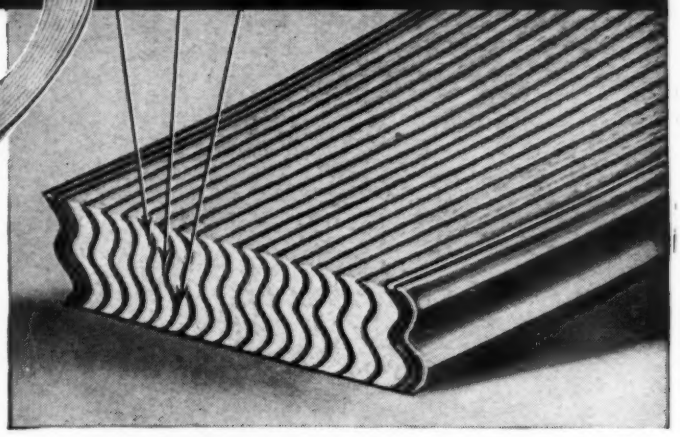
work
DIESEL LOCOMOTIVES
Can ANYONE sell a pump?
No, just anyone can't sell a pump —properly.
It takes a lot of adroit engineering to figure the right pump for any specific job. It takes a broad background of experience to enable a man to be sure he's selling you a pump that will make you a long-term friend and customer.
This engineering ability and experience are yours when you buy from a Fairbanks-Morse-Pomona dealer.
He knows pumps. He has the broadest line to choose from; he's backed by all the engineering and production resources of Fairbanks-Morse. He can offer you skilled, impartial advice—he can sell you the pumping savings and satisfaction you're after.
FAIRBANKS-MORSE
A name worth remembering



Garlock Guardian Gasket—recomended for pipe flanges, boilers and other equipment subject to temperature changes or vibration.

3 Points of Resiliency



This Gasket EXPANDS and CONTRACTS with Changing Temperatures

for Permanently Tight Joints

GARLOCK GUARDIAN GASKETS are constructed of alternate layers of specially shaped strip metal and asbestos. Additional layers of metal are electrically welded together on the inner and outer edges. Result—a very strong gasket that is also *resilient.* Because of its unique structural design, the gasket compresses and rebounds instantly and repeatedly to conform with expansion and contraction due to temperature changes or vibration. Permanently tight joints under severe service conditions are assured.

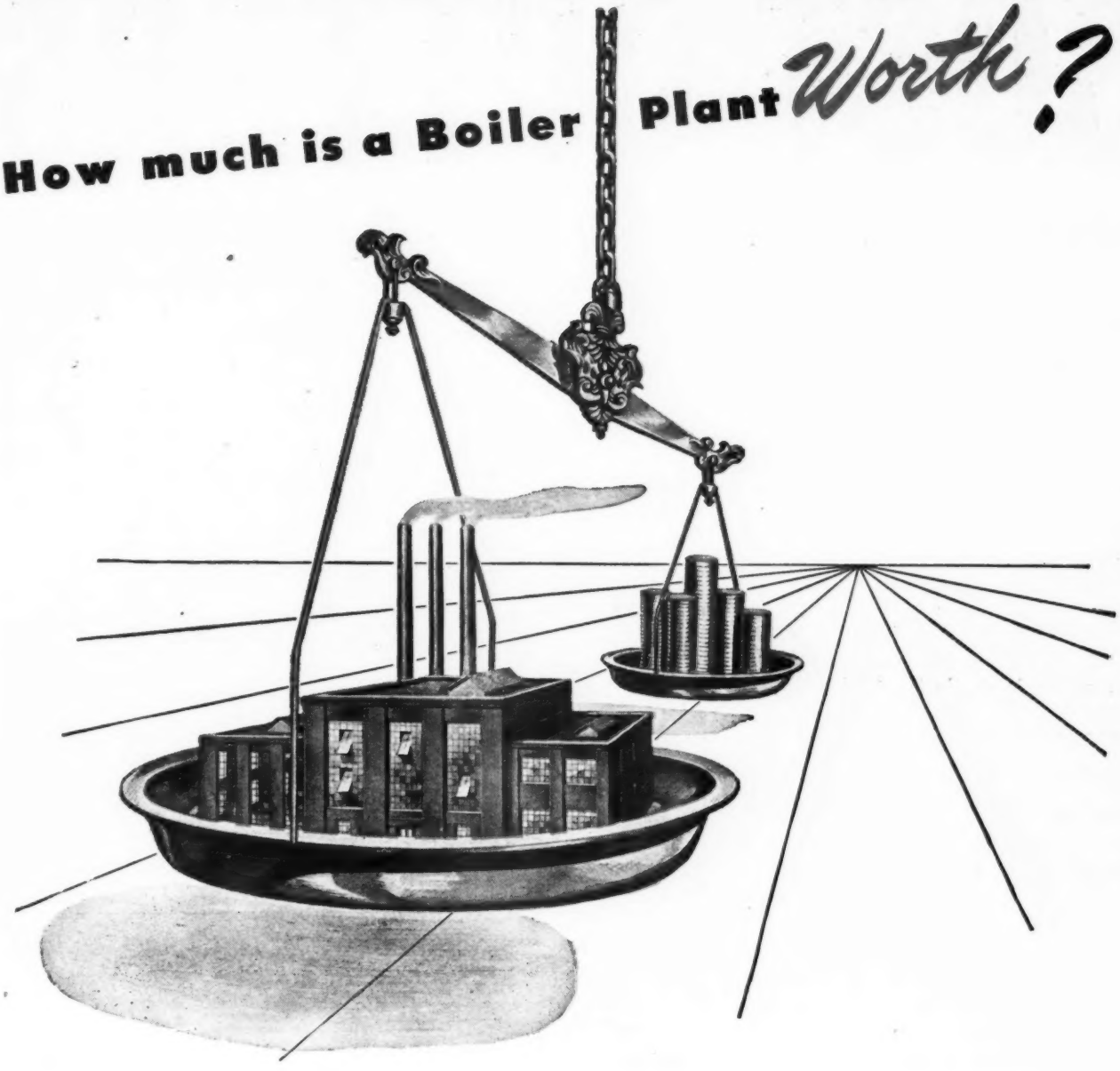
Since metal and asbestos are the only materials used in their construction, Garlock Guardian Gaskets are unaffected by extreme temperatures and pressures. Also they effectively resist gases and liquids which cause many gaskets to disintegrate, as the double thickness of metal on the inner and outer edges forms an impregnable barrier to the destructive action of gases and liquids. Furnished in a wide range of sizes and shapes.

Garlock Guardian Gaskets with *centering rings* are available for raised face pipe flanges and other applications.

THE GARLOCK PACKING CO., PALMYRA, N.Y.
In Canada: The Garlock Packing Co. of Canada, Ltd., Montreal, Que.

GARLOCK *Guardian* GASKET

How much is a Boiler Plant *Worth?*



A boiler plant may *cost* up to any figure you wish to name.

But a boiler plant's *worth* depends entirely upon how efficiently it operates. For instance, how many or *how few* shut-downs you have may depend entirely on the effectiveness of your water conditioning service.

Correct water conditioning is a matter of careful and scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical. Our staff of engineers will welcome the opportunity of discussing your boiler water problems . . . W. H. & L. D. BETZ, Gillingham and Worth Sts., Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

COST CUTTERS

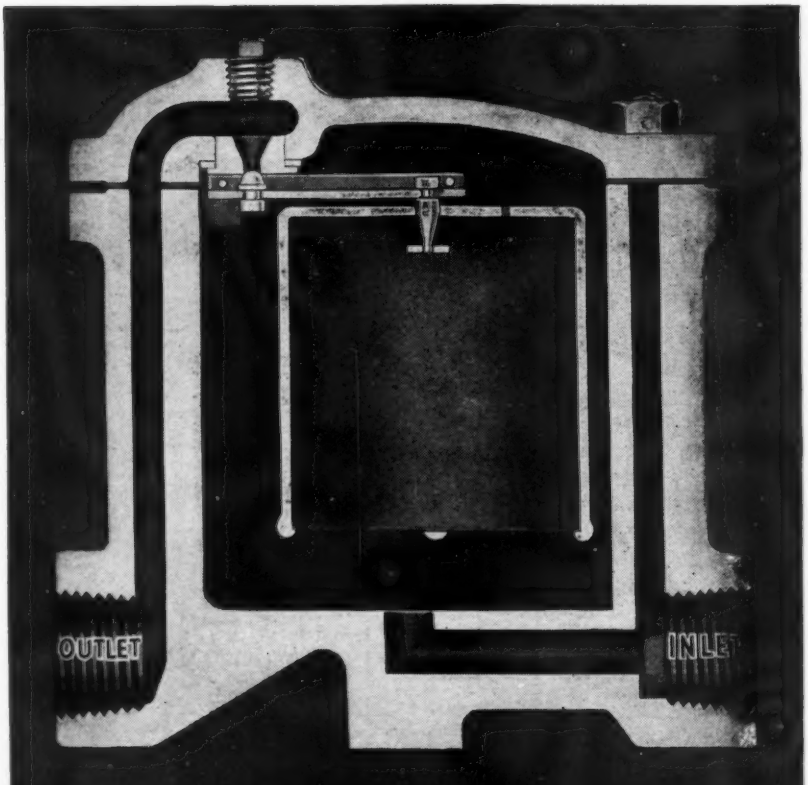
POWER PLANTS . . . cut costs with CLARK STEAM TRAPS. Large volume air removal gives quicker heating up action—saves fuel. Elimination of condensate permits rapid, full flow of new dry, live steam—extends life of equipment.

For 38 YEARS...

fluid controls made by Clark have been saving fuel and increasing equipment efficiency wherever steam, air or gas are used.

Cost Cutters in...

- **Laundry and Dry Cleaning Establishments**
- **Petroleum Refineries**
- **Food Processing and Canning Plants**
- **Meat Packing Plants**
- **Steel Plants**
- **Breweries**
- **Chemical Plants**
- **General Industry**



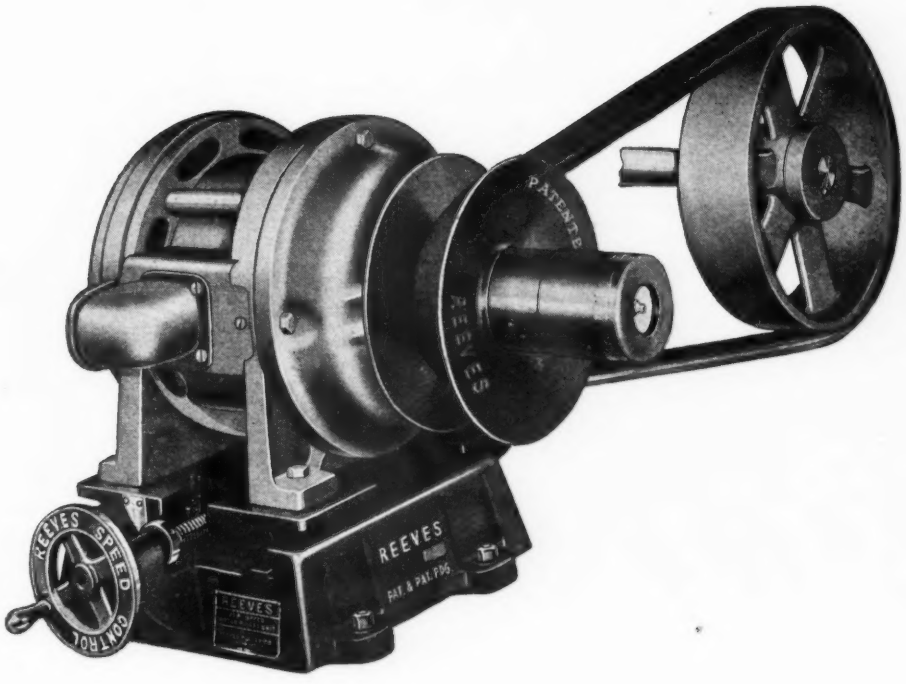
The popular **CLARK SERIES 70** Inverted Bucket Type Steam Trap with Clark patented Bucket Venting Device and other exclusive Clark features. For general drainage service. Available in 3 sizes: ½", ¾" and 1". For pressures up to 200 P. S. I. and temperatures up to 400° F. Write for free catalog for complete specifications and applications of the wide line of Clark Fluid Controls.

Clark
FLUID CONTROLS

THE CLARK MANUFACTURING COMPANY • DEPT.A • CLEVELAND 14, OHIO

Makers of a wide line of fluid controls including

STEAM AND FLUID TRAPS	STRAINERS	PRESSURE REGULATORS
VACUUM AND LIFTING TRAPS	VALVES	REDUCING VALVES



Reeves: a name synonymous throughout industry with accurate, variable speed control

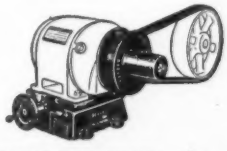
In the plants of some 25,000 manufacturers and processors you will find, today, more than 260,000 production machines equipped with infinite, stepless REEVES Speed Control. On the blueprints and catalogs of machine manufacturers you will also see more than 2,100 different makes of machinery calling for REEVES Variable Speed Drives as standard equipment. And, if you'll take a look at the record, you'll soon discover why REEVES is thus accepted as a name synonymous throughout industry with accurate, variable speed control. For the record shows that in the specialized field of speed control engineering no other manufacturer equals REEVES . . . either in design, manufacturing and application experience . . . in number or variety of installations . . . in dollars-and-cents savings to the user . . . in completeness of line . . . or in the quality of service rendered those who build and use REEVES-equipped machines.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

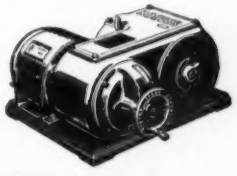
Recognized Leader in the Specialized Field of Speed Control Engineering

THE THREE BASIC REEVES SPEED CONTROL UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

Accurate Variable

REEVES Speed Control

Gives the Right Speed for Every Job!

Day and night cowboy for $1 a month!

Stock farmers cheer loud and long for electrically charged fences.

This electric cowhand keeps herds in pasture 24 hours a day. And the cost for power? It's probably less than a dollar a month.

And this is only one of many blessings that electricity has brought to rural areas.

Abundant electric power at a reasonable price is no overnight phenomenon. It's the result of careful, long range planning by a farsighted industry—with a major thought always to wider distribution and greater production efficiency.

During long and close association with the industry, American Blower has worked with producers of power to constantly increase plant efficiency.

American Blower manufactures three groups of power plant products: Mechanical Draft Fans, Fly Ash Precipitators and Gyrol Fluid Drives—the popular method for adjustable speed control of mechanical draft fans and boiler feed pumps.

Perhaps you use these products now or know them by reputation. In any event, you will find each makes a contribution to greater overall plant efficiency—in a new plant or in plant modernization.

Why not contact the nearest American Blower Branch Office now? An engineer, trained to serve your needs is ready to give you full benefit of American Blower's experience and facilities.

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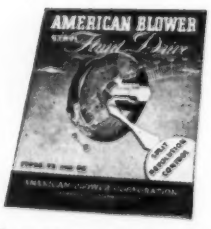
AMERICAN BLOWER

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

4 books on products to improve overall power plant operation

Gyrol Fluid Drive for Boiler Feed Pumps—Bulletin No. 8019



Gyrol Fluid Drive for Mechanical Draft Fans—Bulletin No. 7019

Fly Ash Precipitators (Series 361) Bulletin No. 1628

American HS Forced Draft Fans Bulletin No. A-703

GO TO AN ASBESTOS EXPERT

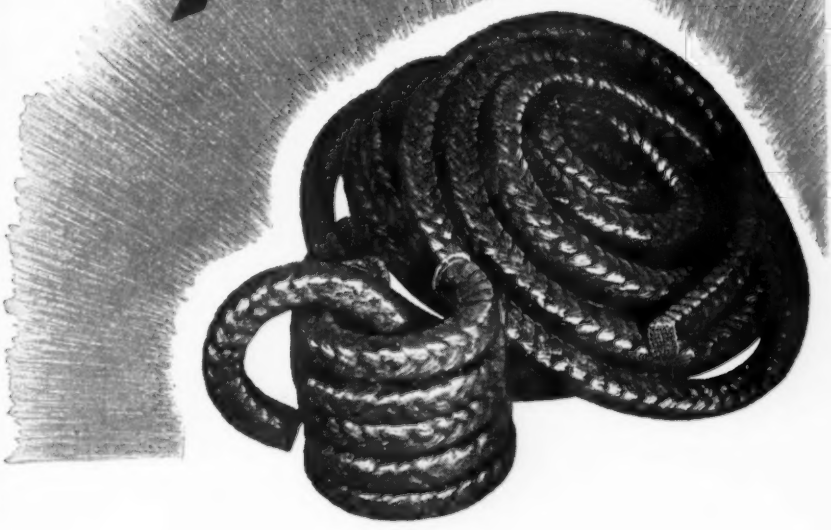
When it's too hot to handle!

Where there is need for asbestos safety clothing, it is needless to say the *best* is needed . . . And you're sure it's best when it's Palmetto Asbestos.

Greene, Tweed & Co., manufacturers of famous Palmetto Asbestos products, are pleased to announce that Palmetto Asbestos Safety Clothing is again available. To meet the demands for many new types of gloves, mittens, aprons, coats and other garments, the line of standard products is now far more comprehensive than that which existed before the war.

Illustrated above are a few representative products. For literature covering the entire line or particulars on special safety clothing, write Department S—Greene, Tweed & Co., North Wales, Pa.

PALMETTO *Palco*



NEVER SCORES FOR YOU

So you win!

If you've been experiencing scored pump sleeves in centrifugals handling cold water, you've got the wrong packing in your line-up. Put Palmetto Palco in the box to bat for your side . . . This self-lubricating long staple cotton packing always makes a hit with chief engineers, master mechanics and maintenance men *because it cannot score!* Write today for more particulars on this and other famous packings on the Palmetto team.

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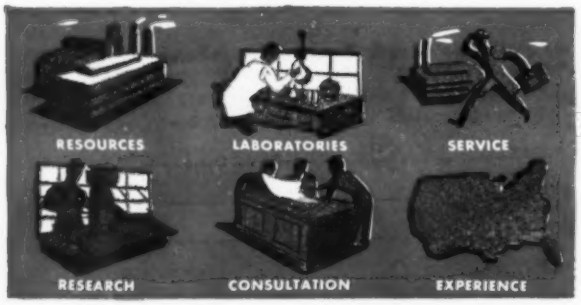
Worth looking into

SERVICE—Trained servicemen are maintained at key locations all over the United States and Canada to assure users of Ameroid Complete Boiler Water Treatment that boilers will be maintained free from scale, corrosion and carryover.

When you look into the AMEROID system you'll find it backed by all the factors necessary for a completely successful boiler water treatment . . . a national service organization of trained chemists and engineers; modern analytical laboratories; controlled manufacturing facilities; a progressive research program; and the "know how" that comes only from wide experience. An AMEROID representative will be happy to discuss boiler water conditioning with you at your convenience.



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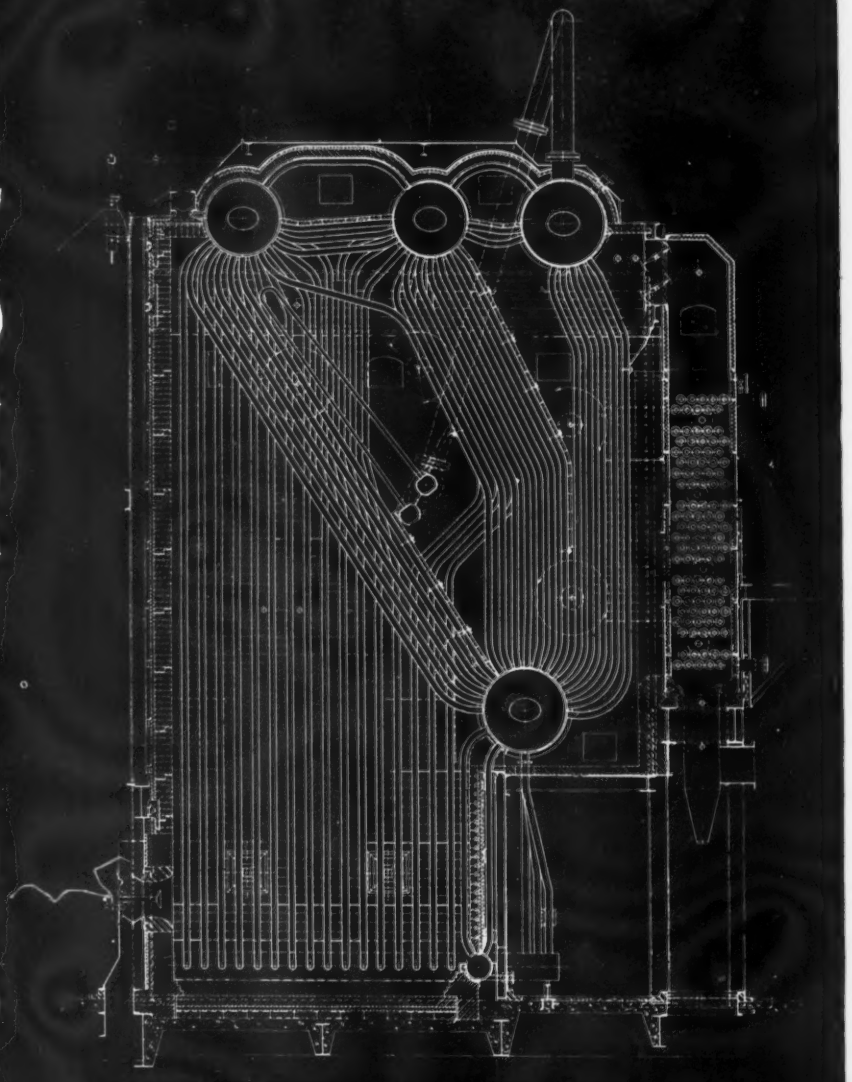
COMPLETE AMEROID SERVICE is available in key cities of the United States, Canada, Mexico, Brazil and Puerto Rico.

WICKES 4-DRUM BOILERS

TIME TESTED AND POWER PROVEN



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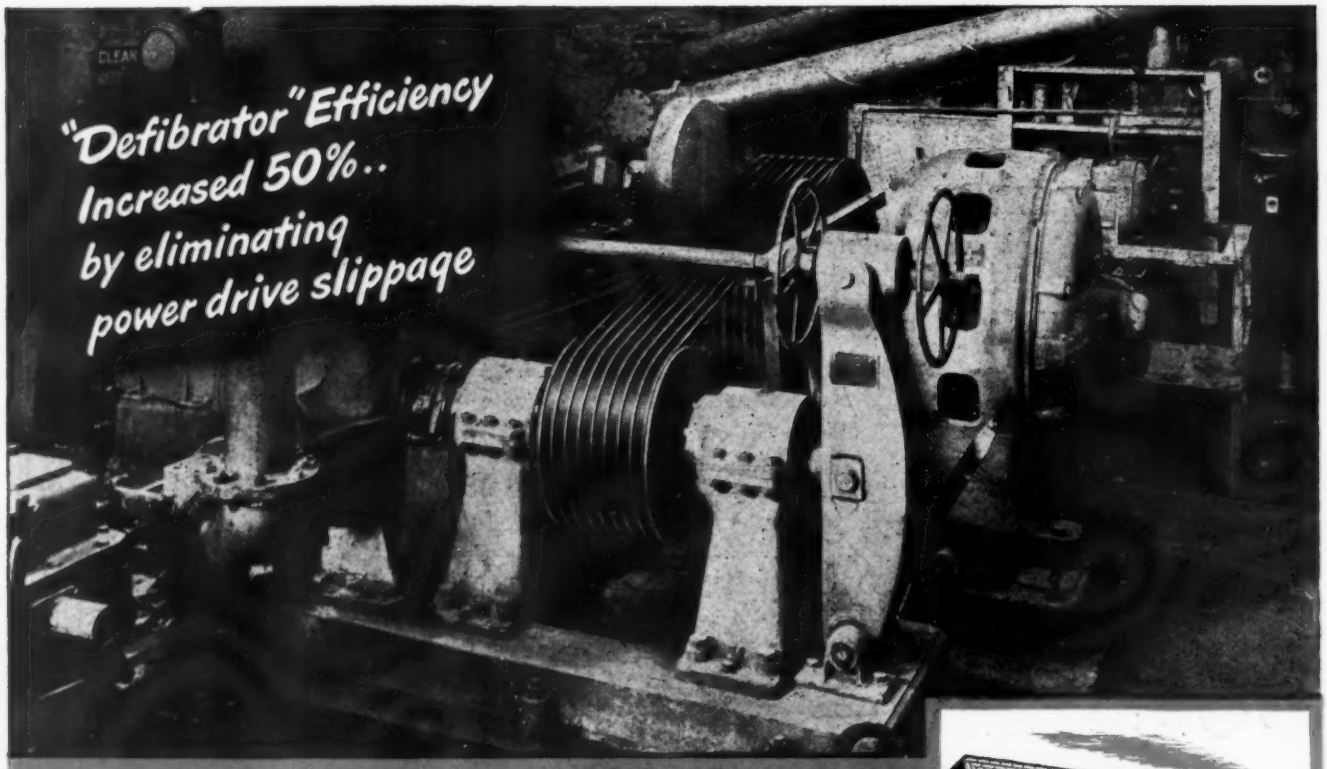

WHY DAYTON V-BELTS *Eliminate Slippage*

Pulverizing 16 to 18 cords of wood a day into pulp used in manufacturing sound-deadening and roofing felts is a tough job. The original belts on the power drive for the wood "defibrator" machine frequently slipped, often stalling the machine completely. To eliminate belt slippage, the original drive was replaced by a Dayton V-Belt Drive seven years ago. Machine efficiency immediately increased 50% and excessive wear on machine parts, due to frequent starting and stopping, has been greatly reduced.

Dayton V-Belts eliminate slippage because, as the pull on the V-Belt increases, it seats itself, actually wedges itself, firmly in the pulley grooves. That's why extra heavy loads merely cause Dayton V-Belts to take a tighter grip on pulleys and continue to deliver power positively and smoothly. Call your Dayton Distributor today.

DAYTON RUBBER • DAYTON, OHIO

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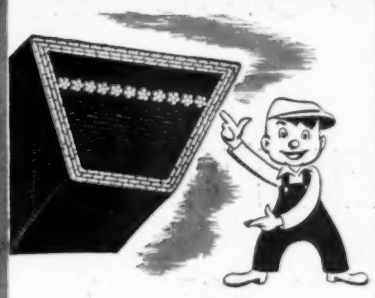


NOW!

* *Rayon Cords*

Provide Dayton V-Belts with

1. **MINIMUM STRETCH**
2. **GREATER FLEX STRENGTH**
3. **LONGER V-BELT LIFE**

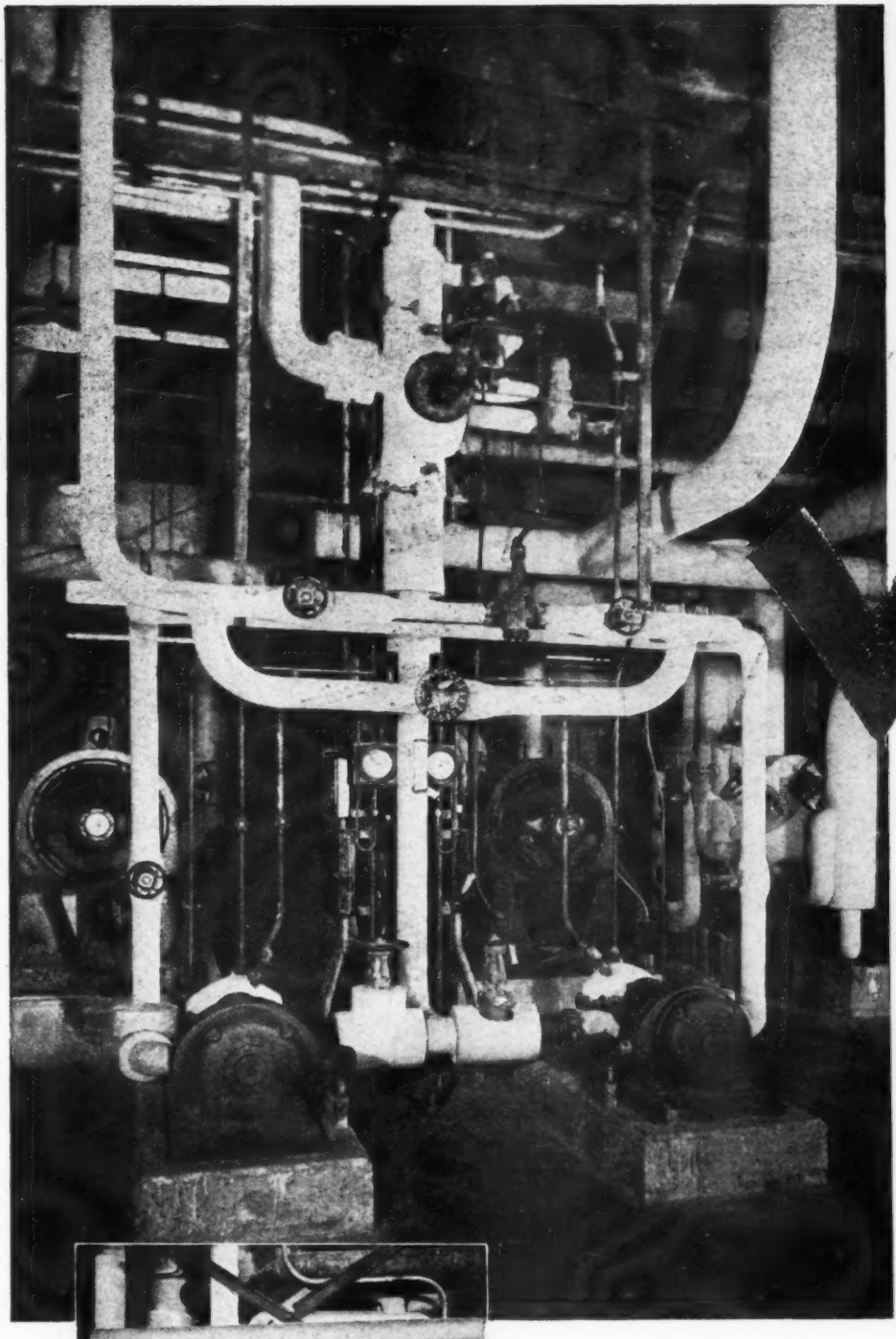
* Rayon cords are *specially processed* by Dayton for use in V-Belts to provide the most efficient and economical power transmission service for your needs. For the complete story write for booklet A-469.

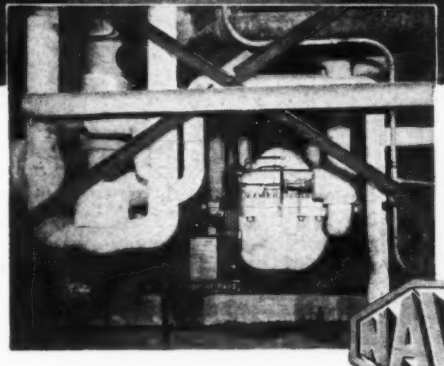
V-BELT BUYERS! A leading mill supply house near you stocks Dayton V-Belts.. Look for the name in the yellow pages of your telephone directory

Dayton Rubber

THE MARK OF TECHNICAL EXCELLENCE IN NATURAL AND SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS





NAVCO PIPING INSTALLATIONS ARE THOROUGH

The measure of any piping system, after the proper design has been reached, is the "fit". The knowledge which we have gained in the past 40 years is your guarantee of an accurate and workmanlike piping system. Navco quality in work manship and design is evidenced by the many success- every industry. Consult Navco for your next piping job. fully operating installations which we have made for

NAVCO PIPING

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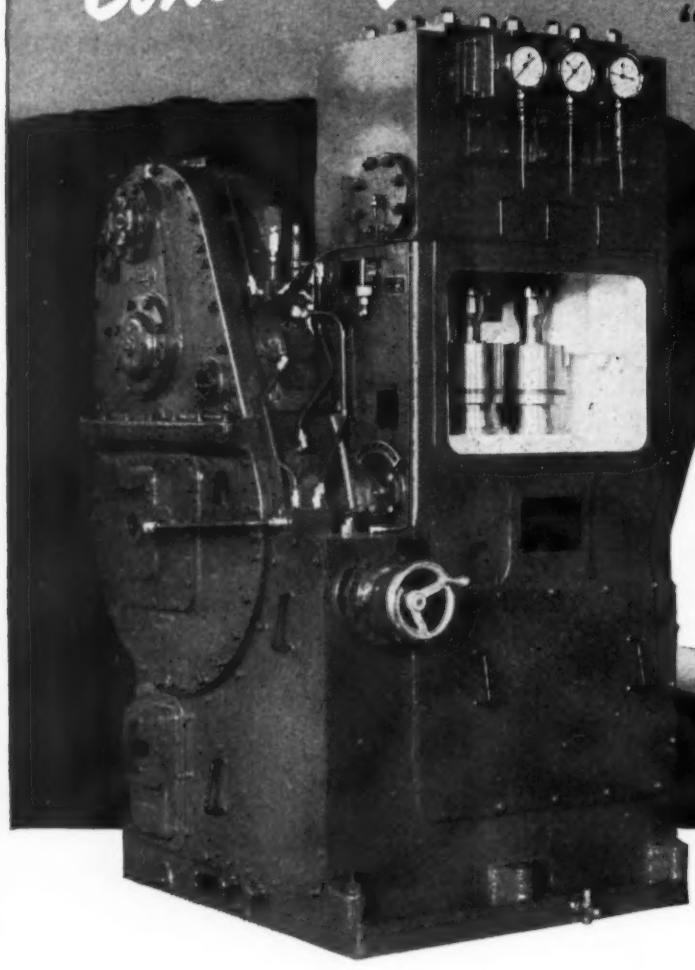
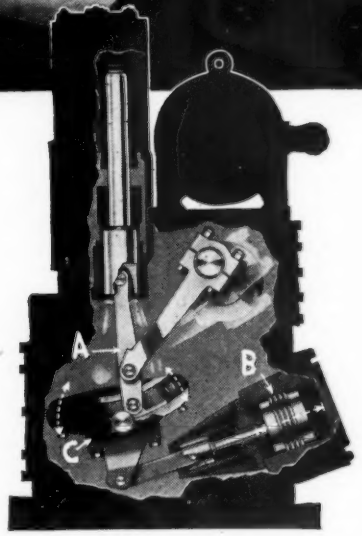
Control of Delivery IS A SIMPLE MATTER . . . with ALDRICH-GROFF "POWR-SAVR" PUMPS



IN MEDIUM AND HIGH PRESSURE SERVICES

For

- *Boiler Feeding*
- *Desuperheater Feeding*
- *Process Charging*
- *Pipe Line Pumping*
- *Hydraulic Pressure*



Power is supplied to plunger by connecting rod through a link (A). Length of plunger stroke is controlled by piston (B) which positions stroke transformer (C). In zero stroke position, the link has a pendular motion and the plunger is stationary. To increase delivery, the stroke transformer (C) is tilted, so that the link motion is given a vertical component which actuates plunger through any travel up to full stroke.

Unique in their efficient use of power for variable delivery requirements, Aldrich-Groff pumps operate at constant speed and their power consumption is practically proportional to delivery. Users report substantial power savings as well as low maintenance expense.

Discharge is varied manually or automatically, either at the pump or from a remote station. The variation is stepless from zero to full capacity.

Aldrich-Groff pumps are available in six standard sizes, ranging up to 100 bhp and to 15000 psi. Their use is increasing wherever power savings, extreme mechanical reliability and simple, accurate control of delivery is important. Over 300 units in successful operation for periods ranging up to 6 years.

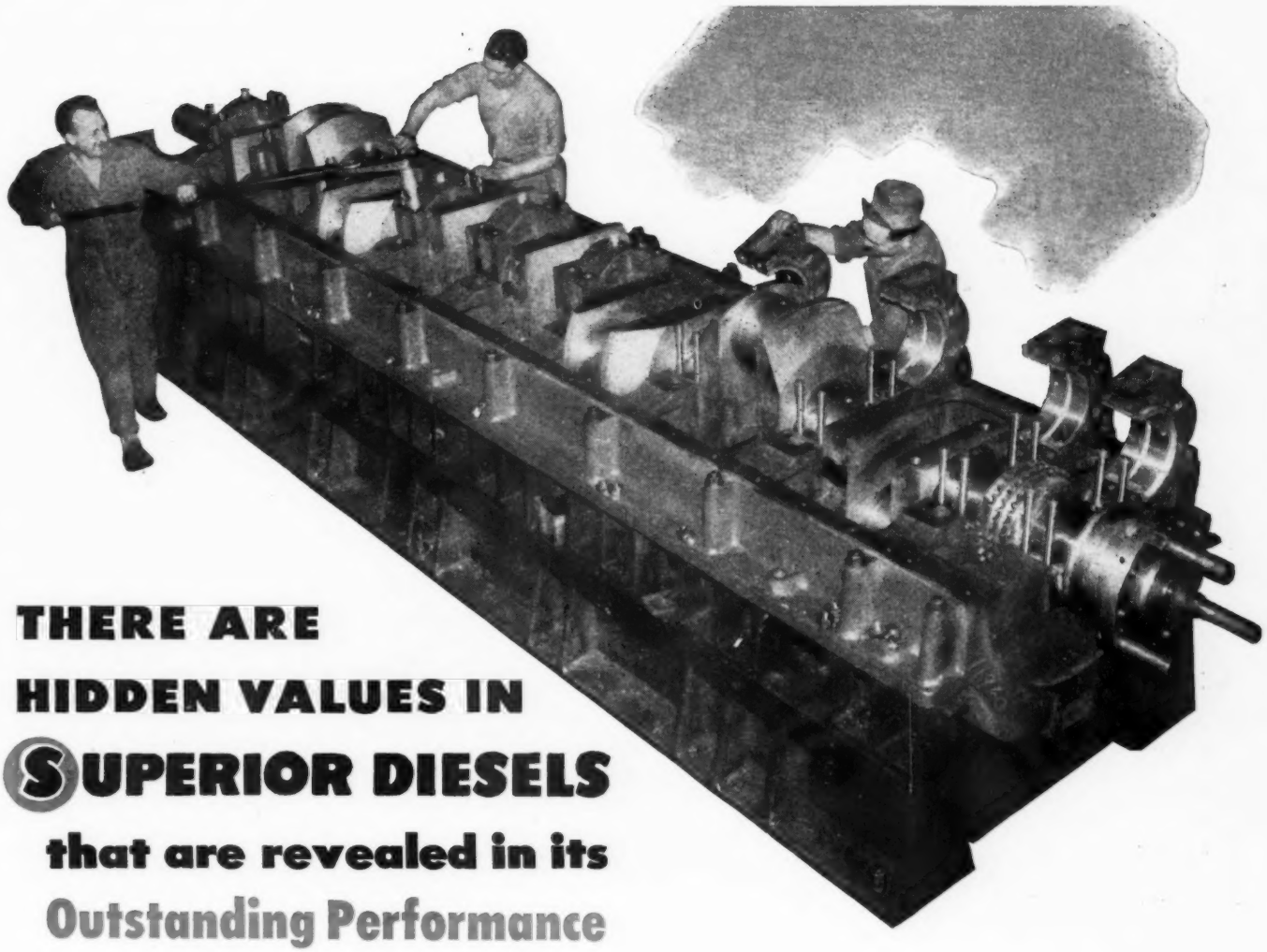
For full particulars, write today for Data Sheet 65.

The Aldrich Pump Co., 3 Gordon Street, Allentown, Pa.

Representatives: Birmingham • Bolivar, N. Y. • Boston • Chicago • Cincinnati • Cleveland Denver • Detroit • Duluth • Houston • Jacksonville • Los Angeles • New York • Omaha Pittsburgh • Philadelphia • Portland, Ore. • Richmond, Va. • St. Louis • San Francisco Spokane Wash. • Syracuse • Tulsa

ALDRICH

. . . anticipates industry's pumping needs



THERE ARE HIDDEN VALUES IN SUPERIOR DIESELS that are revealed in its Outstanding Performance

You can look to Superior Diesel Engines for outstanding performance. Skilled craftsmen make sure of that. Using precision tools and methods they build brute strength and stamina into every engine.

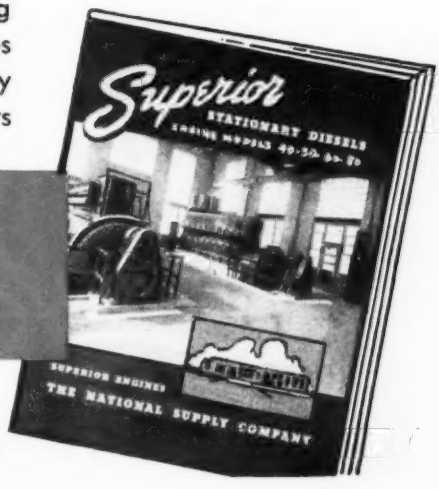
To give Superiors this extra value, no detail is overlooked. The crankshaft bearing supports are a good example of the painstaking care that marks every manufacturing step of these tough engines.

Bearing supports are bored in line to close tolerances. This permits the use of precision bearing shells for the crankshaft journal and eliminates shimming for bearing clearances. The desirability of this feature has been proved for many years in automotive engine practice. It provides a valuable maintenance advantage because parts fit exactly . . . slip into place easily . . . and there are no delays or errors caused by outmoded cut and try methods.

One of our field engineers will be glad to point out all the hidden advantages that make Superior Diesels an outstanding value. Just write and tell us when he can call.

Superior DIESEL

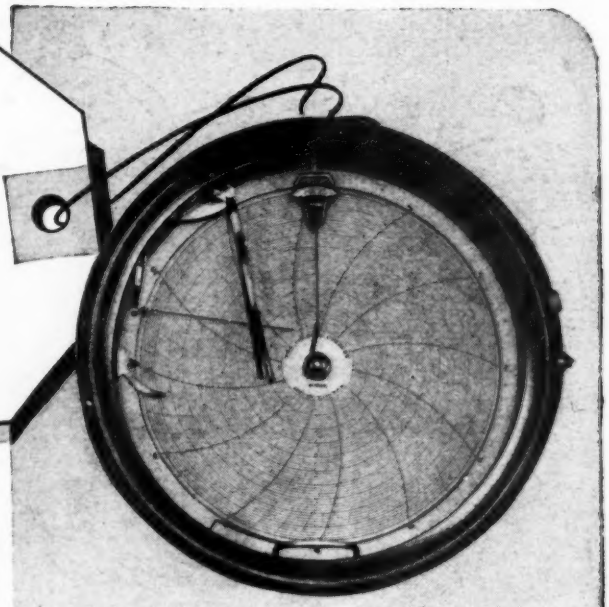
SUPERIOR ENGINES DIVISION OF
THE NATIONAL SUPPLY COMPANY
Plant and General Sales Office: Springfield, Ohio



Send for this Booklet

A new 28 page booklet, "Superior Stationary Diesel Engines" is just off the press. It's packed with facts that tell *how, when and why* Superior Diesel Engines can help you build profits. Write for your free copy today.

Automatic Cure for Plugging of Travelling Intake Screens



Simple FOXBORO Control System operates screen whenever suction level drops . . .

HERE'S AN EASY, inexpensive way to make sure that your condenser well won't go dry if excessive refuse causes sudden plugging of the travelling screen.

Foxboro Travelling Screen Control supplements periodic screen-timing with a "judgment" that's almost human. By continuous measurement of water level on each side of the screen, this sensitive control system independently starts the cleaning action whenever a predetermined safe differential is exceeded. When correct levels are again restored, it automatically shuts down screen and spray motors. In case of unusually severe fouling of the screen, the controller can also operate a warning signal.

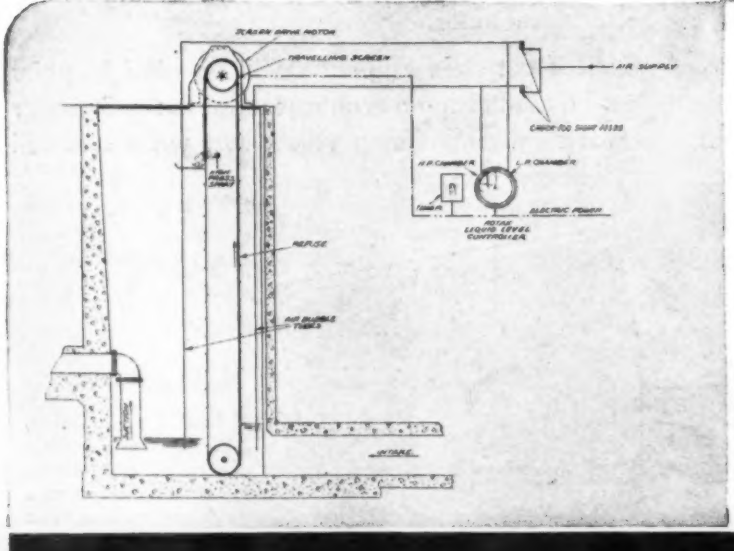
Write for complete information on Foxboro Travelling Screen Control and Bulletin 184-4 containing details of Foxboro Rotax Controllers. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.**

ROTAX

Liquid Level Controller

The "heart" of Foxboro Travelling Screen Control. An extremely simple, positive-operating controller that translates level differential into operation of motors. In addition, it can operate a warning horn or light in case of unusually severe plugging.

Exclusive Rotax features include: positive electrical contact; special lock-up circuit which eliminates chattering of control relays; constant brush pressures; self-cleaning platinum contact surfaces; easy setting of control point; and freedom from maintenance.



SCHEMATIC DIAGRAM, left, shows simplicity of Foxboro Travelling Screen Control System. Water level differential through the screen is continuously measured by bubble tubes. The Foxboro Rotax (electric) Controller starts and stops the screen and spray motors, as required to maintain safe differential.

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● Among the many coal-handling systems where Gifford-Wood is responsible for designing and erecting every last detail, is this job for the U. S. Asbestos Division, Raybestos-Manhattan, Inc., Manheim, Pa. Others – widely diverse in character from this plan – also have been G-W from start to finish.

● Only one element is fixed on a job where G-W shoulders all details: *savings*. You're always assured savings from increased speeds in the movement of coal – from intake to stoker hopper . . . in space required for storage . . . in labor cost through utmost mechanization in coal handling.

Backed by 130 years' experience in solving specialized problems, G-W has thoughts on material-handling systems that are good for your pocket-book. Investigate Gifford-Wood's *complete* engineering service today.

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Accurate Pressure Control with

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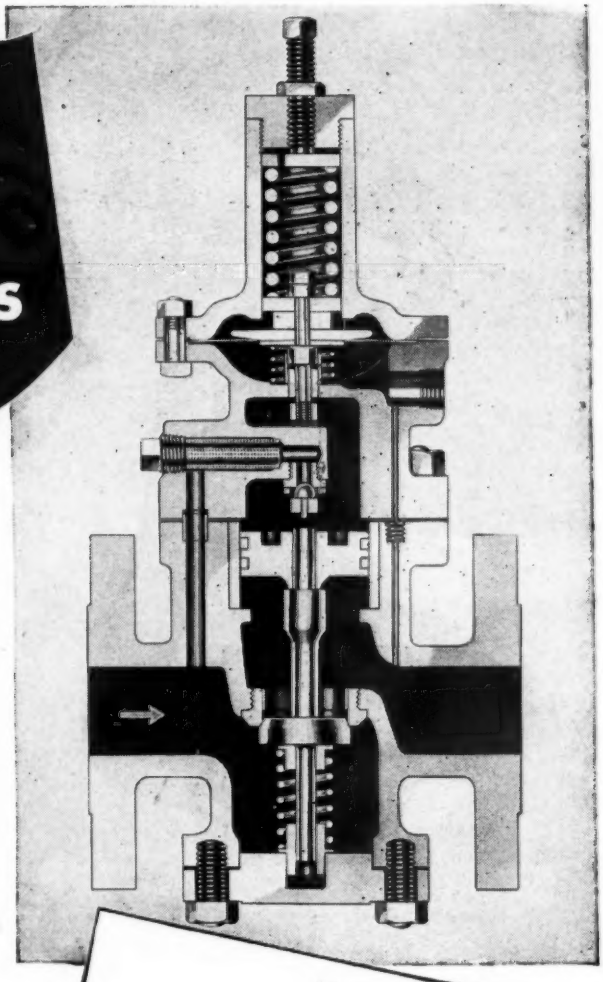
STRONG
IMPROVED
Regulating Valves
STEAM • AIR • GAS



For Sensitive Pressure Regulation, Use This Single-Seated, Pilot-Controlled Valve!

Recommended especially for:

- **Processes with intermittent or fluctuating demand;**
- **Processes requiring extremely sensitive control;**
- **Applications where dependability is essential.**

STRONG Type C Valve, illustrated at right, available in semisteel or cast steel, for pressures to 400 psi (600° F.). With ANUM-METL* seats and discs, optional internal or external pilot control, this valve automatically adjusts itself to maintain accurate reduced pressure.

Completeness of the STRONG line—steam traps, vacuum traps, pressure regulating valves, strainers, separators, continuous blowdown valves and other steam specialties—enables us to recommend exactly the right type and size for your particular application. Write us about your problem and ask for the new STRONG Regulating Valve Catalog No. 155.

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STRONG improved strainers, of semisteel or cast steel construction, protect reducing valves, steam traps, control equipment, etc., by taking out scale, dirt and sediment. Available in "T" or "Y" types.

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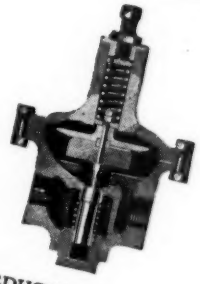

TYPE K REDUCING VALVES are direct operated, single seated and of extra heavy semisteel construction suitable for pressures to 225 psi (400° F.). Features ANUM-METL seat and disc and internal strainer. For steam, air, water or gas.

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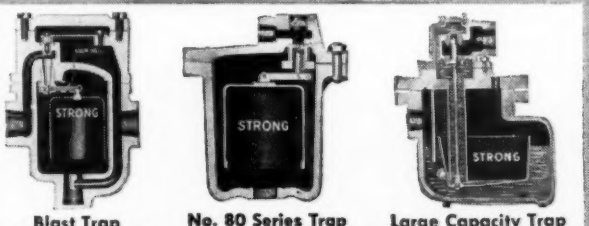

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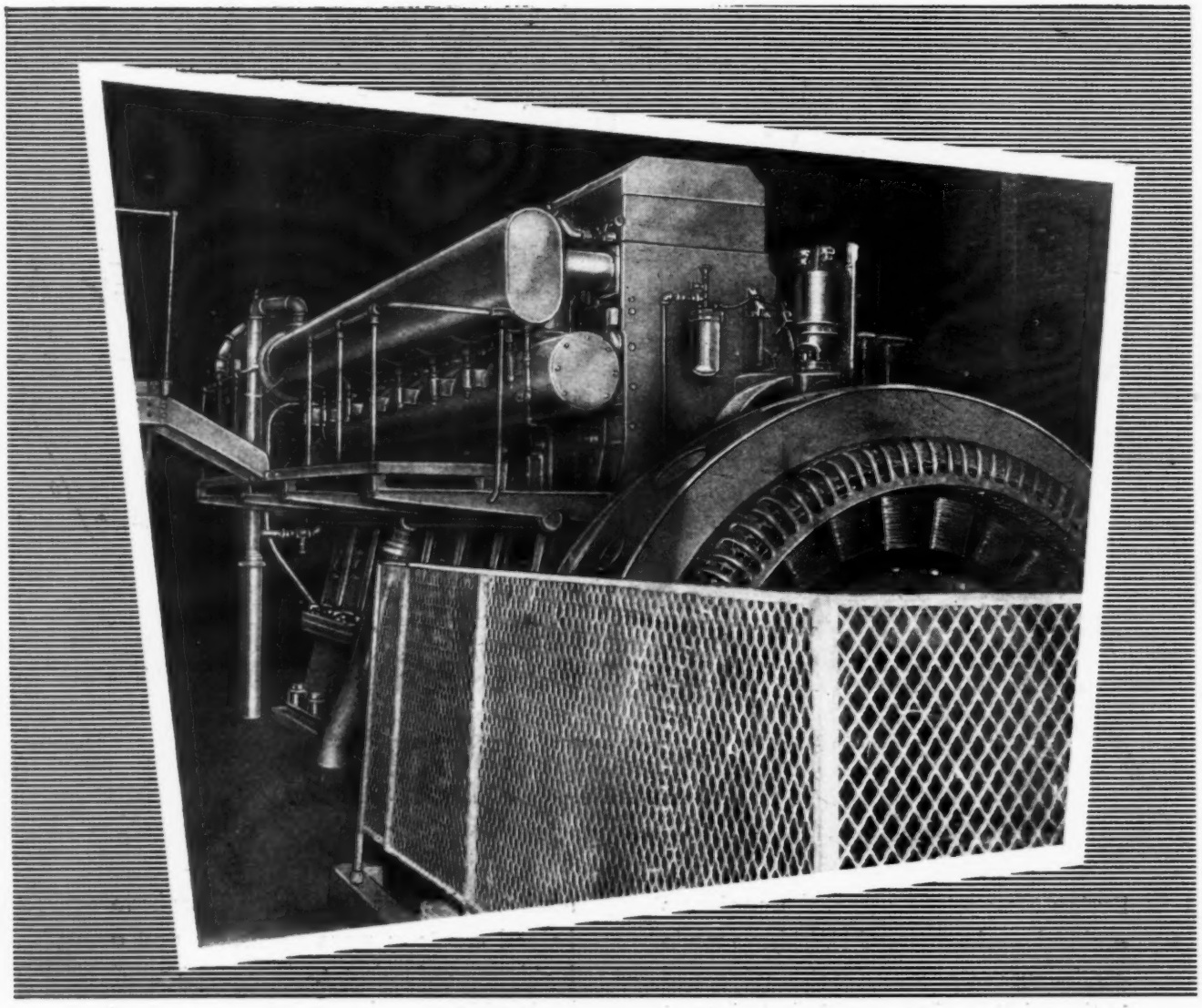

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Years of reliable performance and low cost power have won for Chicago Pneumatic an outstanding position in the Diesel field.

CP Diesels have proved profitable investments for public utilities, industrial, municipal, ice and water-works plants, and in mining, oil, pipeline, cotton ginning and other fields where low cost, dependable power is a vital necessity. Write for complete information.

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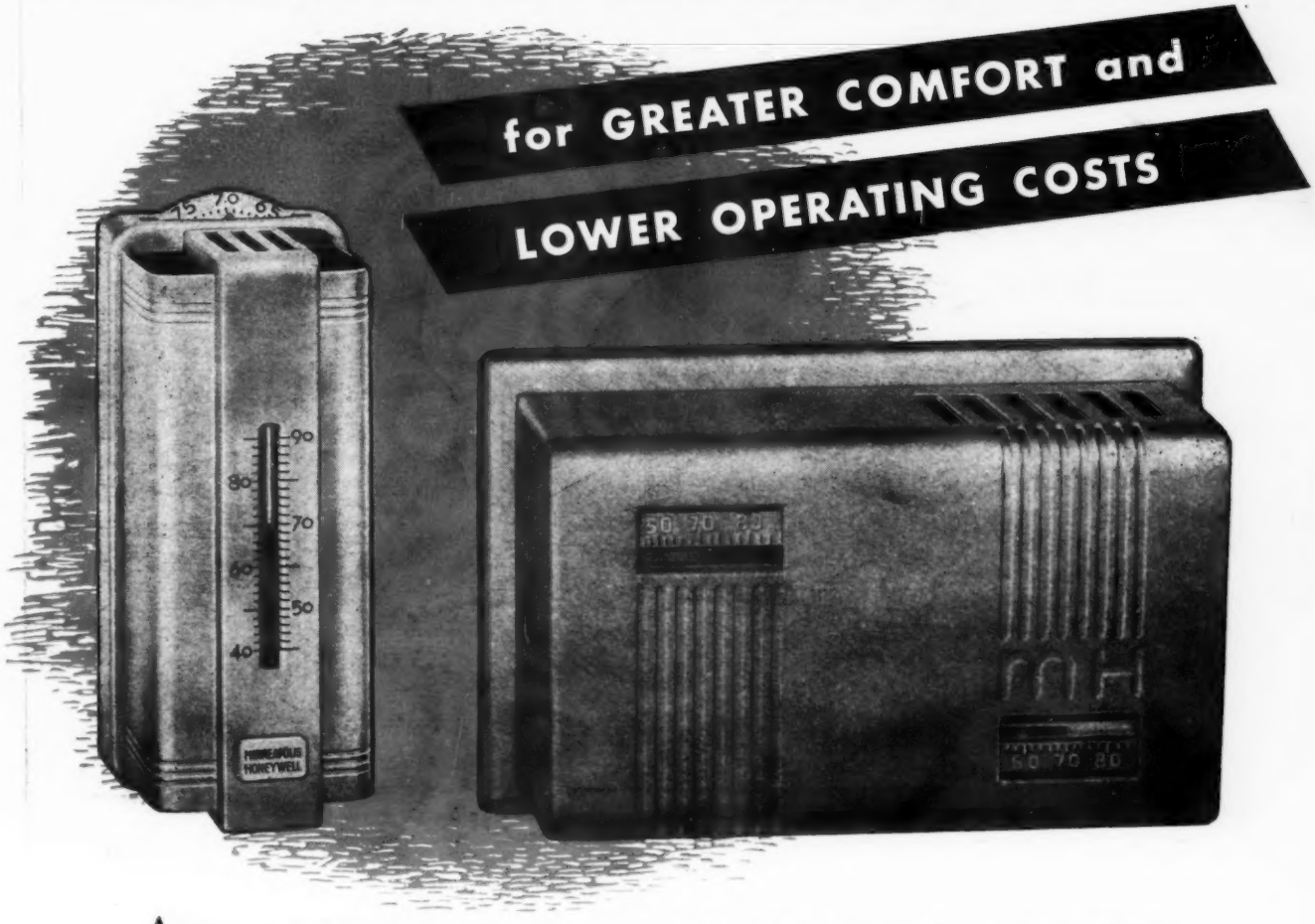
for GREATER COMFORT and LOWER OPERATING COSTS



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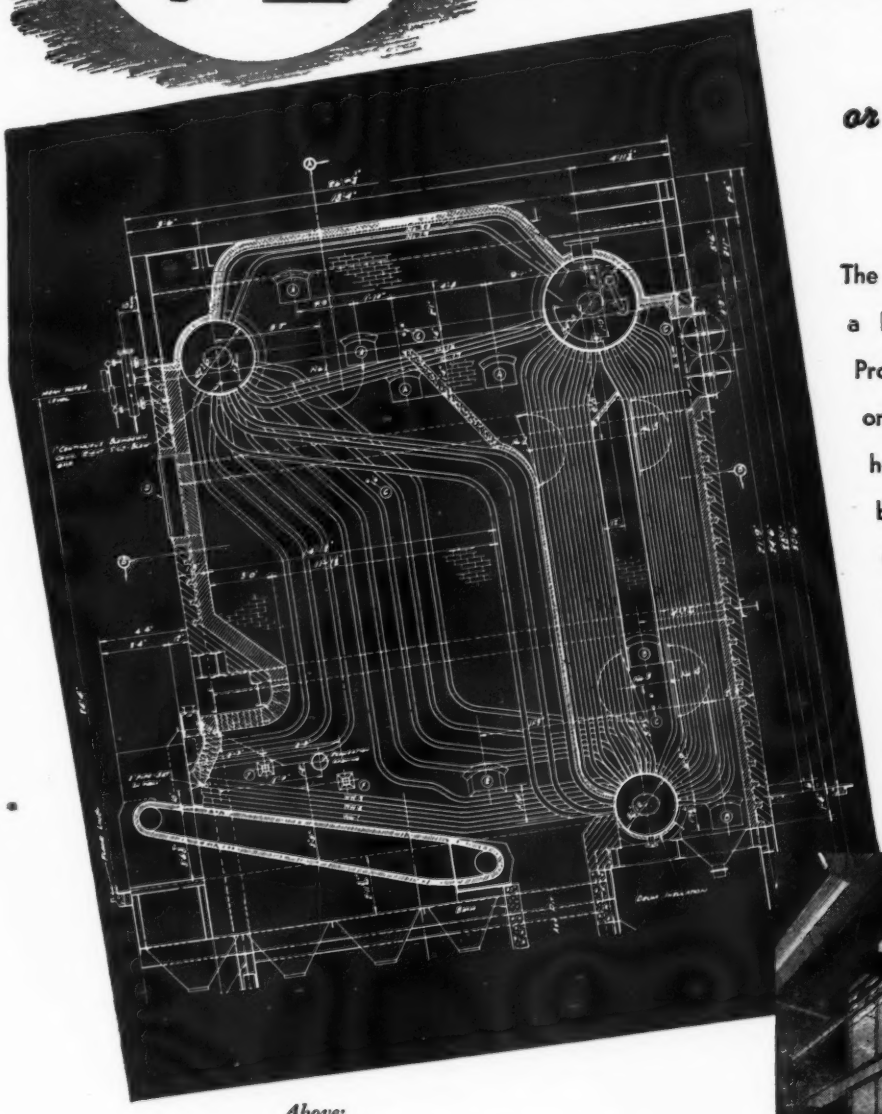
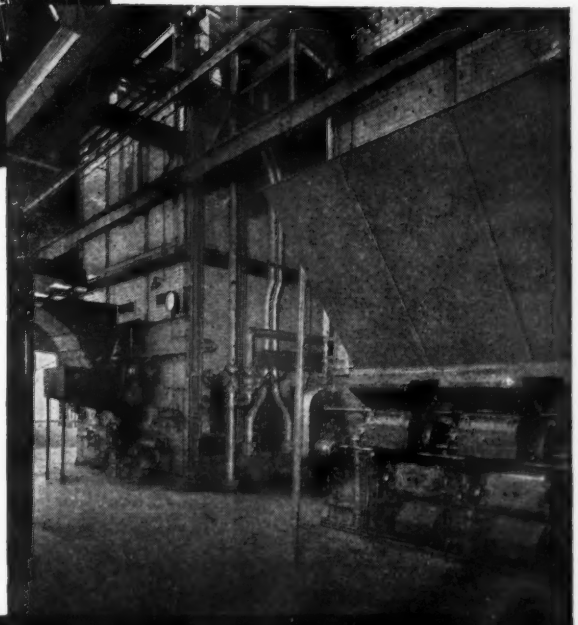


Above:
This 90,000 lbs. steam per hour unit, designed for 475 lbs. pressure, serves the Mansfield Tire & Rubber Co., Mansfield, Ohio.



Right:
Two 515 H.P. units installed in Brown-Forman Distillers Corporation, Louisville, Ky. Plant.

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(Advertisement)

How To Rebuild Stacks By Arc Welding

By R. H. Davies, Consulting Engineer
Cleveland, Ohio

A NUMBER of recent smokestack reclamation jobs offer cost-saving suggestions for power plant engineers. Generally speaking, these employ the use of new steel plate and welded construction for most economical results and greatest freedom from future corrosion.

Fig. 1 shows restoration work on the badly corroded 120′ stack of a public utility steam plant. A new welded casing of ¼″ plate was erected around the lower 60 , the top half having been similarly repaired several years before. Diameter of the stack is 7′ 6″. Plates were shop-cut and rolled so that four plates would cover the stack, and edges were scarfed for a 60° beveled joint. Two welders on the scaffolding erected the new casing, the welds coming over the existing rivet heads. Welded with 5/32″ "Fleetweld 5" electrode in two passes, a stringer and a weaving bead.

In similar manner a steel mill completely replaced 14 smokestacks at one-half the usual cost. The stacks, 155′ high and 6′ 8″ in diameter, were badly corroded and warped, with many rivet heads out entirely. The new stacks, 8″ larger in diameter, were built around the old, permitting operation of the furnaces during the work. The old stacks were then knocked down inside the new structures and removed a piece at a time from the bases.

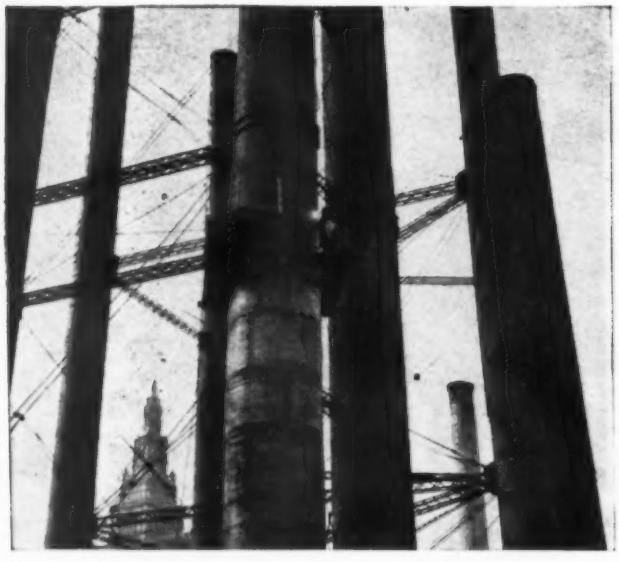


Fig. 1. Restoring this stack with new welded casing was cheaper than tearing down stack and relocating guy wires and struts.

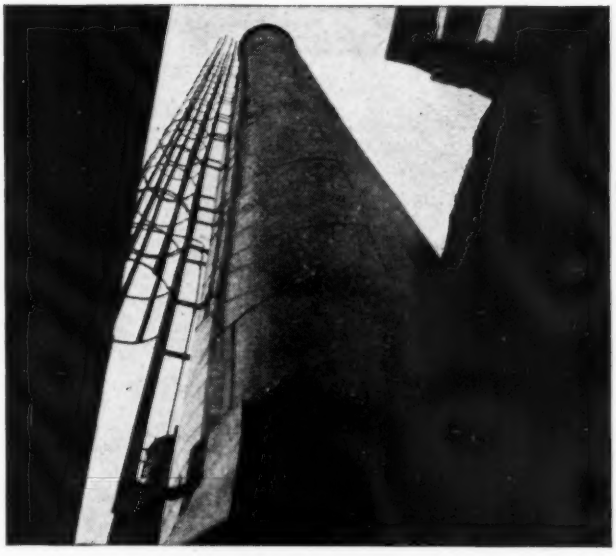


Fig. 2. New welded stack at steel mill, showing tie-in with old tapered base.

The old tapered base was first reinforced with eight 5″ channels welded in place by continuous fillets to the old material (see Fig. 2). Tapered plates were welded directly to the tops of reinforcing channels and fillet-welded to the bottom section of the new stack.

Each section of the new structure was made up of two pieces of half-round formed plate butted together and welded with 5/32″ "Fleetweld 5." Fig. 3 shows part of the new welded stack under erection around the old riveted stack.

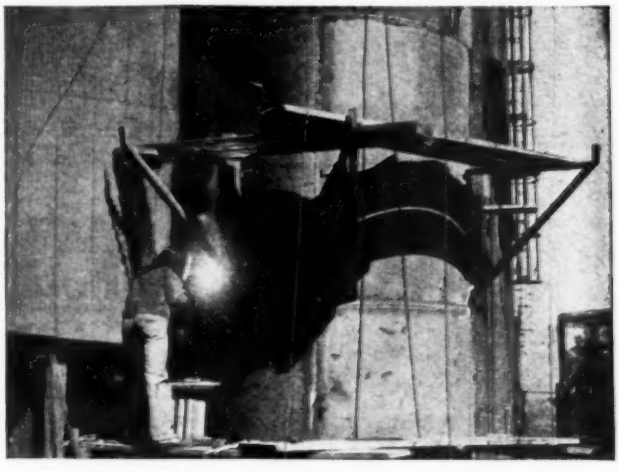
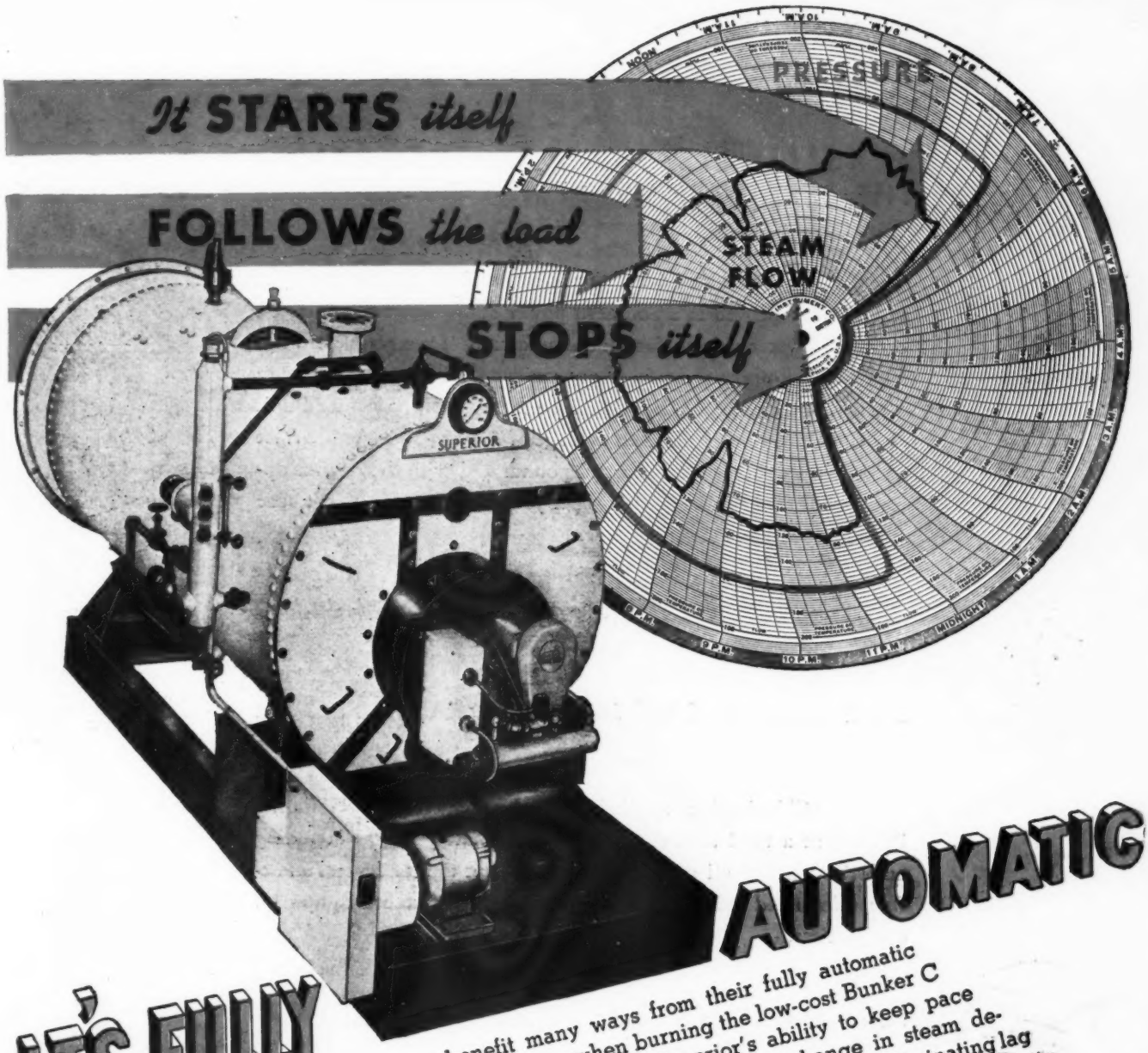


Fig. 3. Erection of new stack around old stack in progress.

The above is published by LINCOLN ELECTRIC in the interests of progress. Specifications and procedures for "Fleetweld 5" and other Lincoln electrodes are given in the "Welding Guide." Write The Lincoln Electric Company, Dept. 462, Cleveland 1, Ohio.



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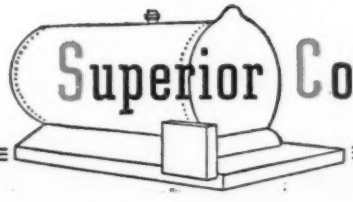

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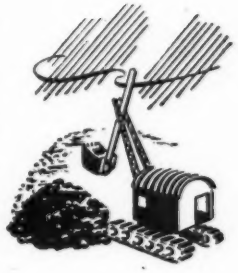
THE HIGH COST OF BACK-PRESSURE: $21000/year

Just exactly how high the cost of back-pressure really is was recently proved in a Southern power station. Slime-fouling on condenser water side surfaces accumulated between plug cleanings to build back-pressure up from approximately 0.6″ to a maximum of 1.1″. That extra back-pressure on a 30000 KW base load unit *boosted* steam consumption an average of 7500 pounds per hour. At a cost of about $0.34 per thousand pounds and with the turbine operating 24 hours per day 350 days per year, the cost of back-pressure figures out to be $21000 per year.



THE LOW COST OF CORRECTION: $5000/year

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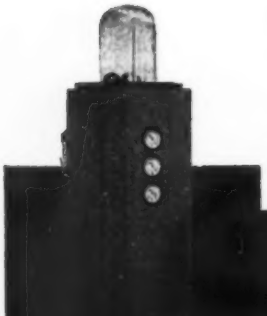

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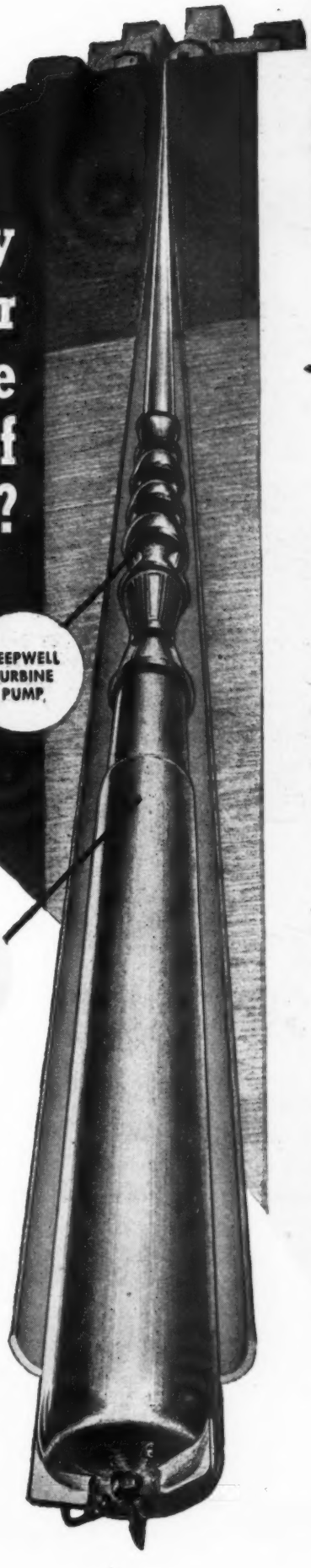

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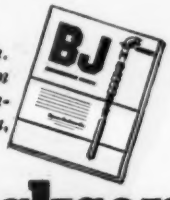

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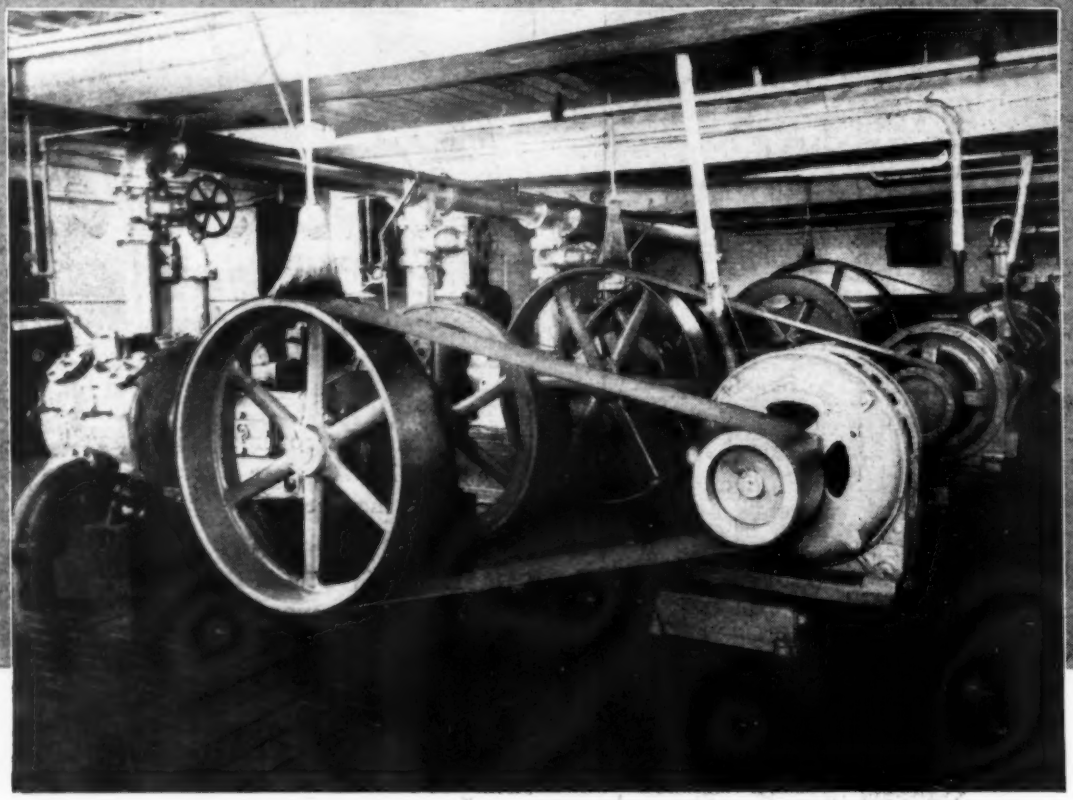

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Diesel Engine DANGER points

Alloy bearings corroded by unstable lubricants

The high pressures and temperatures in present-day Diesel engines greatly accelerate oxidation of some lubricants. Under such conditions, these oils tend to become corrosive and attack the lead in the copper-lead structure of alloy bearings. This leaves a porous copper shell which breaks down under pressure. The illustration shows how an alloy bearing looks after operation with an uncompounded oil.

RPM DELO Oil gives bearings 3-way protection against corrosion

1. RPM DELO Diesel Engine Lubricating Oil base stocks are naturally resistant to oxidation, the cause of most lubricants becoming corrosive.
2. RPM DELO Oil is *compounded* to further reduce the danger of oxidation.
3. RPM DELO Oil's oxidation inhibitor gives bearings direct protection against corrosion.

In addition, RPM DELO Oil is compounded to prevent ring-sticking, to reduce wear by clinging to high-temperature areas most oils leave bare, to eliminate foaming.

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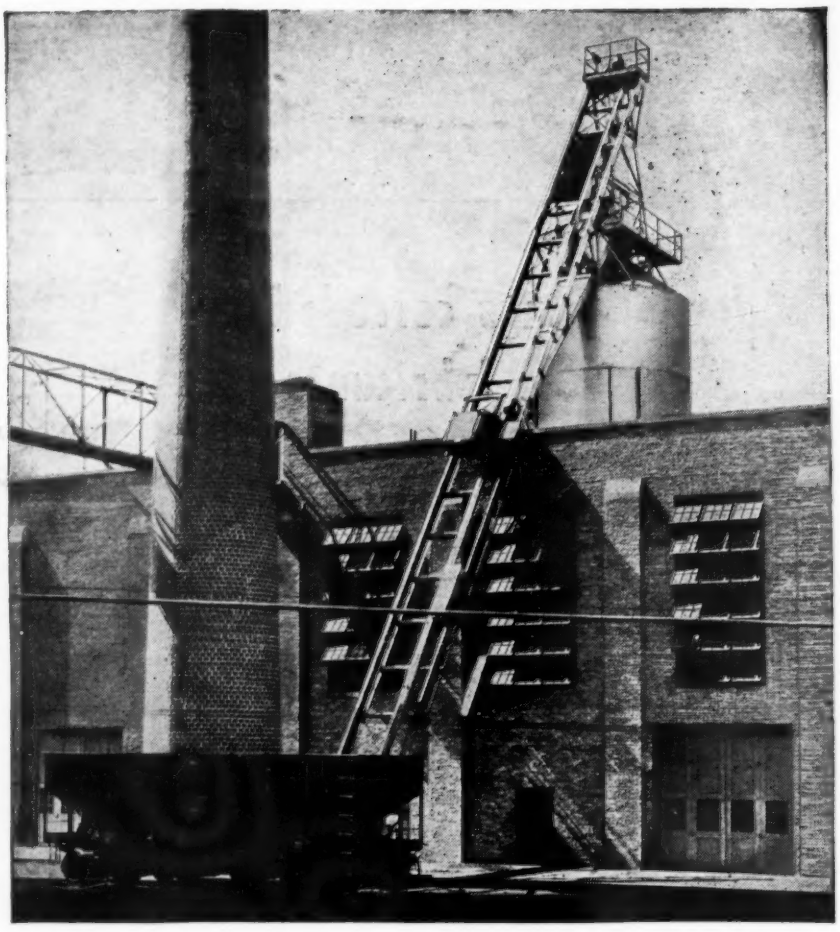

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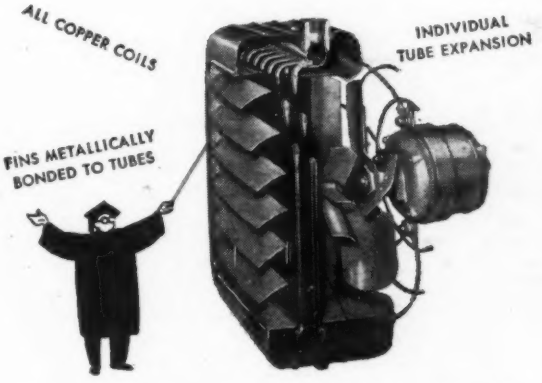

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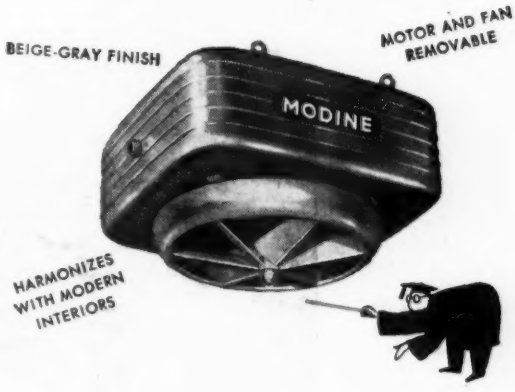
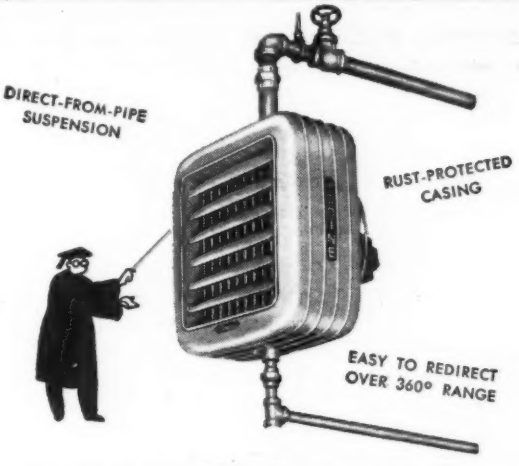


2. What Price BEAUTY?

These functionally designed, stream-lined Modines are easy on the eyes — and ears too! Their heavy-duty, totally enclosed motors are noise-proofed for hush-hush service, certified for quietness by laboratory sound ratings.



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M-O-D-I-N-E spells the Best in Unit Heating

47 basic Modine capacities mean the right unit for any application. Horizontal Delivery Types for general industrial applications. Vertical Delivery Types for overhead installation. Power Throw Types for special high-velocity use. Buy Modine and you buy *the* quality unit heater — first in beauty and performance. Write for complete information, send in coupon at right.

MODINE MANUFACTURING CO.
1512 Dekoven Street
Racine, Wisconsin

YES! I want all the facts about Modine's Integrated Unit Heater Line. Please send me complete information.

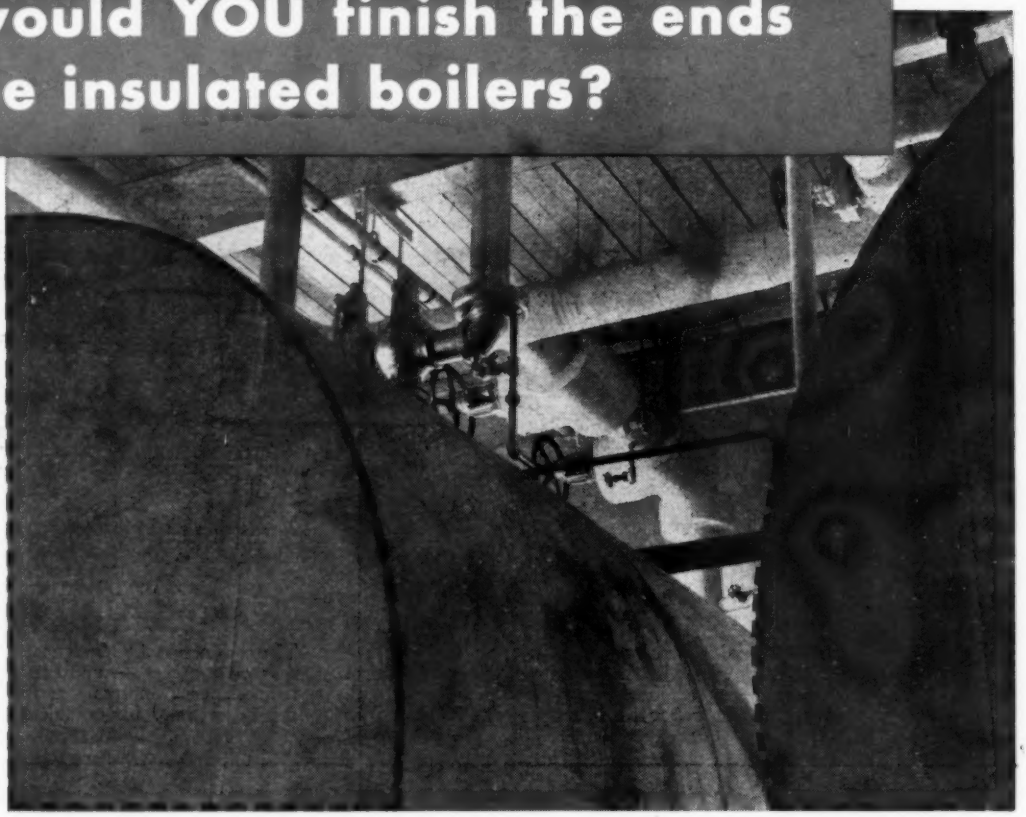
NAME .....

ADDRESS .....

CITY ..... STATE .....

Modine UNIT HEATERS

How would YOU finish the ends of these insulated boilers?



These Scotch marine-type boilers are insulated with 85% Magnesia block 3" thick, finished with a pasted 8-oz. canvas jacket. But the boiler ends, shown here, have reinforcing ribs projecting 2½" out from the casing. What's the best way to finish these ends?

☐ Canvas, same as rest of boiler?

☐ Extra insulation over ribs, covered with canvas?

☐ Asbestos cloth instead of canvas?

HERE'S WHAT THE ARMSTRONG ENGINEER RECOMMENDED:

With heat-transmitting metal ribs only ½" away, a canvas cover would quickly scorch and possibly burn. This makes the first solution impractical. The second plan is better, but it has three drawbacks: it would require a good deal of extra insulation, the heat saved would be trifling, and installing the finish over the closely spaced ribs on the boiler ends would be a time-consuming, costly job.

The most advantageous method is the third, shown in the photograph. The slight extra cost of asbestos cloth is justified because it is lasting and fireproof. Its slightly rougher appearance is inconspicuous at the rear of the boilers.

In itself, this problem is hardly of major importance. It doesn't affect the over-all efficiency of the insulation or involve much money. But it does illustrate the way Armstrong's engineers tackle a job.

If they are handled carelessly, trifles like this can add up to a sloppy job. But when each detail is given careful thought, by a man with experience and practical know-how, your heat insulation job is more efficient, better looking, longer lasting. That's the way Armstrong tries to do it. We attempt to find the right answer for your individual problems, big or little. Armstrong's Contract Service combines, in one responsible firm, the supply of right materials, the right planning and supervision, and the right workmanship.

FREE INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write for your copy to Armstrong Cork Company, Industrial Insulation Dept., 7009 Maple Ave., Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service
For All Temperatures

From 300° Below Zero

To 2800° Fahrenheit

At the
PAULSBORO, N. J.
plant of
SOCONY-
VACUUM

900,000 lb/hr

COCHRANE ATOMIZING DEAERATOR

CONSTANT expansion of the power plant facilities of the Paulsboro, N. J., plant of the Socony-Vacuum Oil Company culminated in the installation of four new 125,000 lb/hr, 900 psi boilers from July, 1943 to August, 1945. As the greater part of the steam is used in process, steam returns are small and about 75% of the boiler feed water is make-up. This is taken twice daily from the Delaware River on which the plant is located, and the water for these high pressure boilers is chlorinated, demineralized and then passes to a Cochrane Atomizing Deaerator of 900,000 lb/hr capacity. The atomizing deaerator is especially suited to an installation of this kind as water treated in this manner is apt to be corrosive in its action on tray-type deaerators. In the Cochrane Atomizing Deaerator, trays are eliminated and the water is deaerated by means of a high velocity steam jet which finely divides or atomizes it. The process is completely described in Cochrane Publication 4160, which will gladly be sent on request.

COCHRANE
SINCE 1863

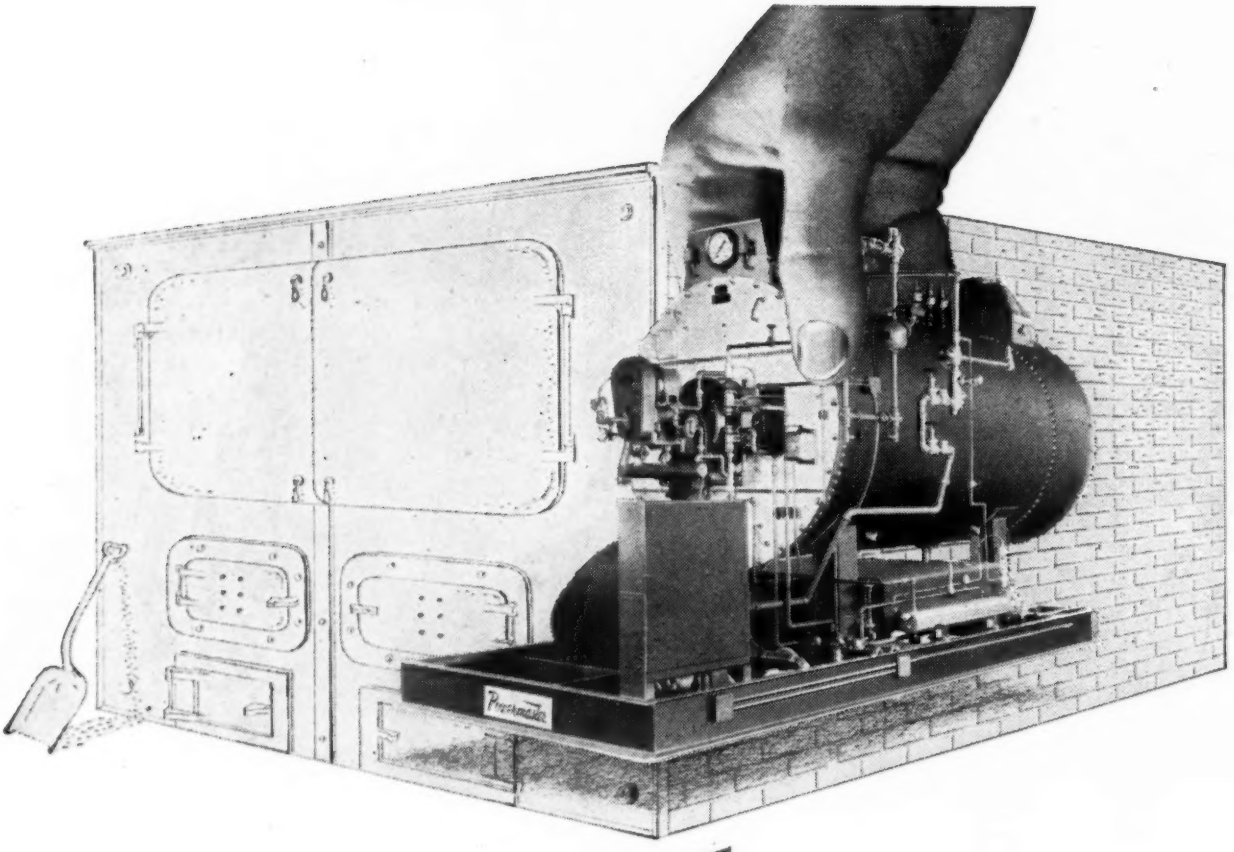
COCHRANE CORPORATION
3106 N. 17th St., Philadelphia 32, Pa.

so many h...

COCHRANE COLD WATER DEAERATOR AIDS IN PRODUCTION OF SYNTHETIC "BEAD" CATALYST

At the Paulsboro plant there is produced a synthetic catalytic agent used in the refining of high test aviation gasoline. One of the ingredients is river water which has been demineralized but is still saturated with oxygen and contains up to 50 ppm of carbon dioxide. A Cochrane Cold Water Deaerator, operating at 35° F. and under vacuum, removes the dissolved oxygen and carbon dioxide at 1650 GPM.

Dutch Danes ...



Set it Down in 1/2 the Space

Ready to Deliver Fast Low-Cost Steam

INSTALLING AN O&S POWERMASTER STEAM GENERATING UNIT will give you all the steam you need, automatically, and save valuable plant space. You get the cleanliness of oil-firing, too. No ashes or clinkers. No dust, dirt or soot. "Now we show visitors our spotless, boiler room as proudly as our offices!" said one plant owner after his "packaged" unit was installed. With boiler, oil-burner, condensate return system and control panel mounted on a space-saving steel base, the Powermaster is the answer to present-day demands for fast, clean, low-cost steam. Write for latest Powermaster bulletin.

ORR & SEMBOWER, INC., 960 Morgantown Road, Reading, Pa.

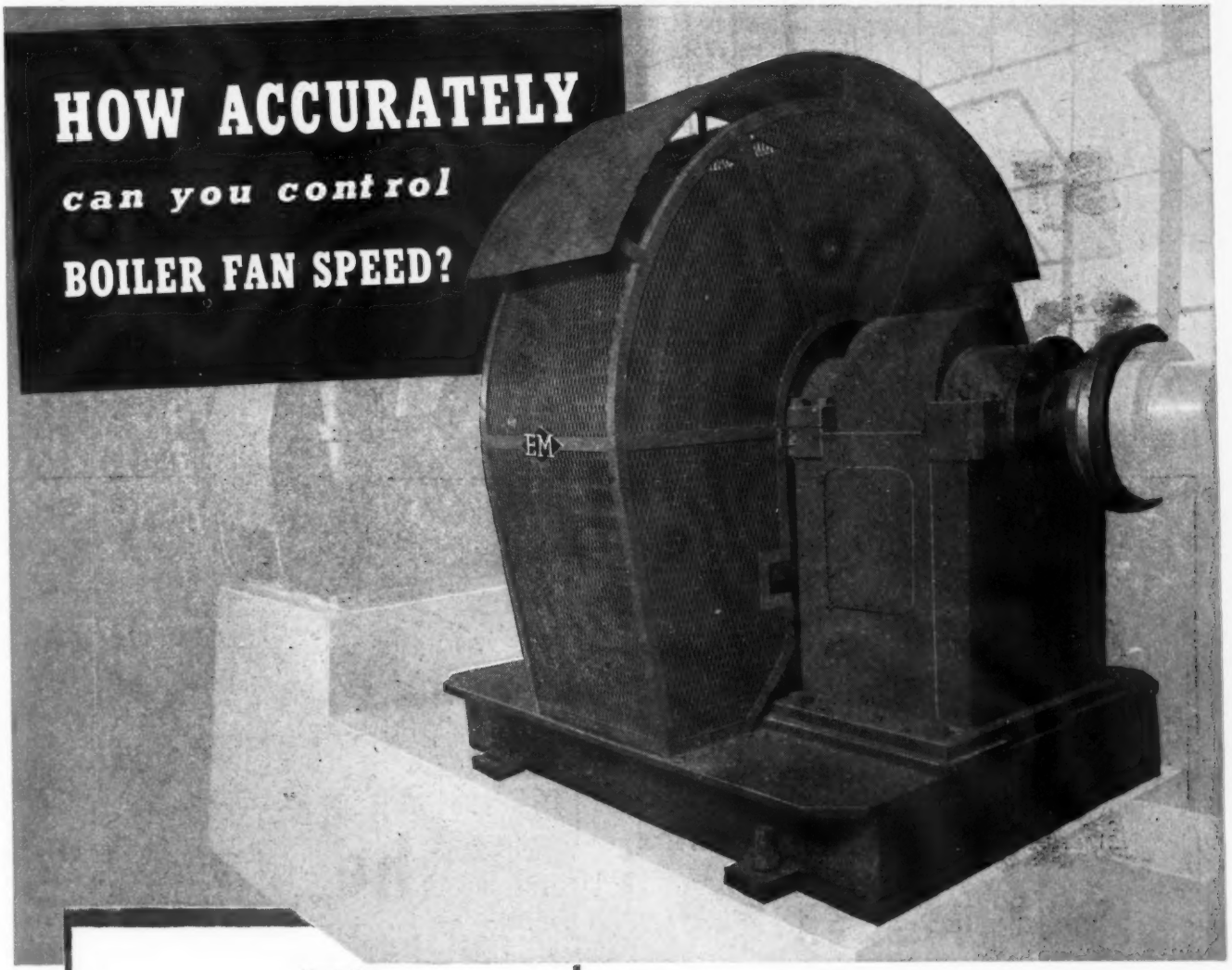
ORR & SEMBOWER

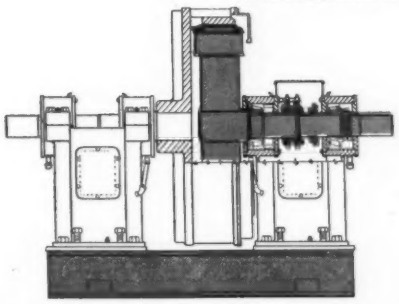
Powermaster*

STEAM GENERATORS

*Trade Mark

HOW ACCURATELY
can you control
BOILER FAN SPEED?





The new Form MD-1 Magnetic Drive is composed of two simple overhung rotating parts without mechanical interconnection. Torque is transmitted electromagnetically between a RING and a MAGNET. A constant-speed motor drives the RING. Rotating within the RING is a MAGNET coupled to the fan shaft. Speed of the MAGNET may be controlled by the Regutron, automatic electronic controller, that adjusts direct-current excitation to MAGNET poles.

AT the Sorg Paper Company, Middletown, Ohio, accuracy *within 1%* is achieved with their recently installed E-M Magnetic Drive. This accuracy of speed control makes possible greater precision in the automatic regulation of mechanical draft under varying steam loads . . . explains why the E-M Magnetic Drive was selected for Sorg's modernization program.

Whenever power plants are modernized, the quick response and the accuracy of adjustable-speed Magnetic Drive assures efficient control of air when steam load varies. Magnetic Drive provides microstep control over a wide range with quick response to change of fan output. It is simple, clean, self-cooling and quiet.

E-M engineers, backed by 50 years of specialized experience in large power apparatus, developed Magnetic Drive and have steadily improved it for maximum dependability. It is the modern method of providing adjustable speed for boiler draft fans.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

Precise, Wide-Range
ADJUSTABLE-SPEED
Magnetic **DRIVE**

A2051

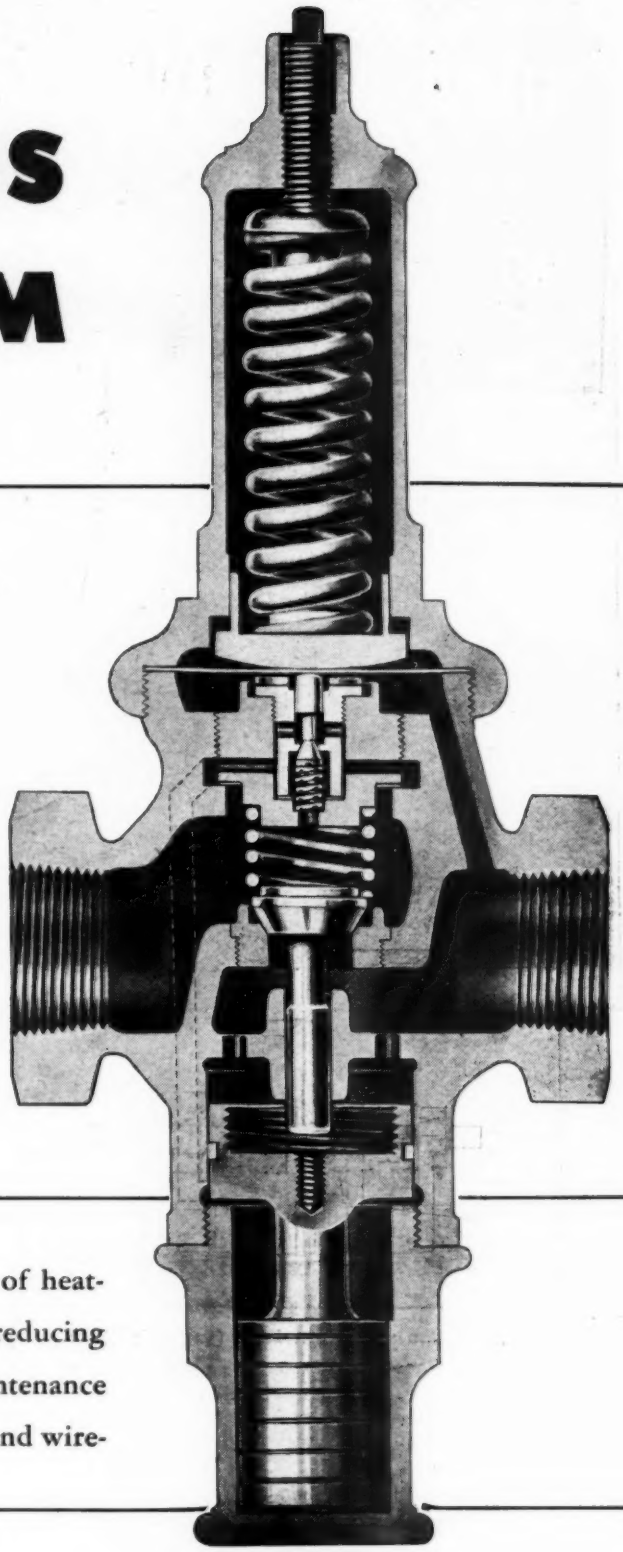
E-M

1897 OUR 50th YEAR 1947

STAINLESS STEEL TRIM

Reduces Maintenance . . .
Assures Longer Operating
Life of . . .

MASONEILAN
No. 11
Reducing Valves



Because the pilot, valve and seats are made of heat-treated stainless steel, Masoneilan No. 11 reducing valves give accurate long life and reduce maintenance by minimizing valve sticking, steam-cutting and wire-drawing. And remember this stainless steel trim is standard . . . costs you no more. Investigate and install Masoneilan No. 11. These regulators will save you money by staying in service longer. Write for catalog, today.

MASONEILAN

MASON-NEILAN REGULATOR CO.

1186 Adams St., Boston 24, Mass., U. S. A.

New York • Philadelphia • Buffalo • Pittsburgh • Tulsa • Cleveland • Chicago
Atlanta • St. Louis • San Francisco • Los Angeles • Houston
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STAINLESS STEEL WELDING FITTINGS

BY MIDWEST

3174

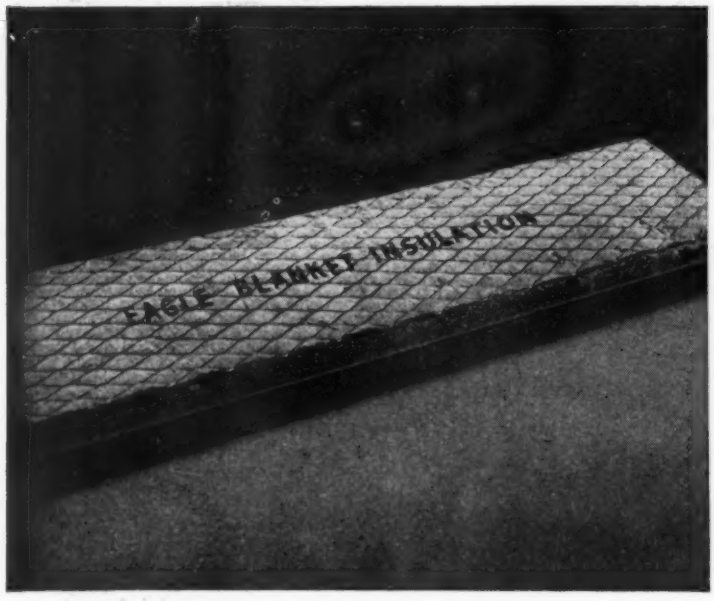
Illustrated here are the various standard Stainless Steel Midwest Welding Fittings. Types 316 and 347 are carried in stock; type 304 and other analyses can be furnished on order. Fittings are hot formed, annealed and pickled; they conform with ASA Specifications for Steel Butt-Welding Fittings.

MIDWEST PIPING & SUPPLY CO., Inc.

Main Offices: 1450 South Second Street, St. Louis (4), Mo.

Sales Offices: **New York (7), 30 Church St.**
Chicago (3), 79 West Monroe St. • Los Angeles (33), 520 Anderson St.
Houston (2), 29 Shell Bldg. • Tulsa (3), 533 Mayo Bldg.
South Boston (27), 426 First St. • Distributors in Principal Cities.

MIDWEST WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS



More power
to you, with
EAGLE-PICHER
Insulations

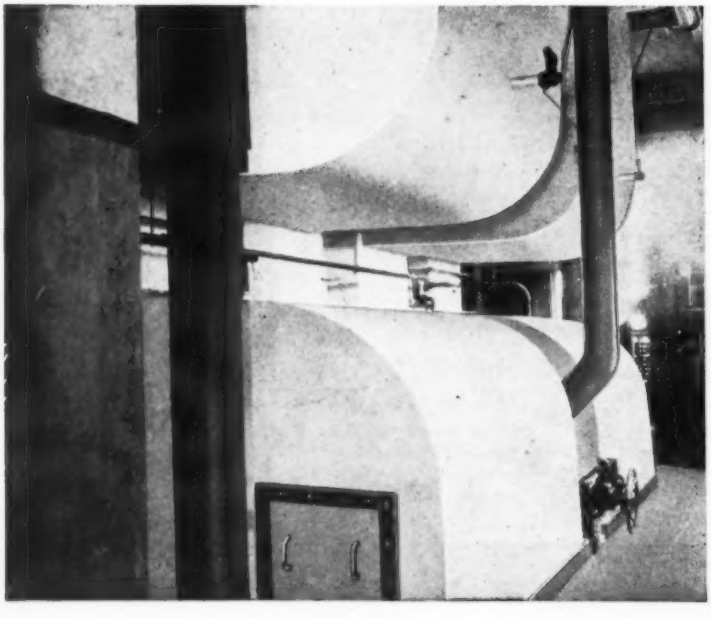
Eagle-Picher Mineral Wool Blankets

are physically and chemically stable!

Long service on heated equipment does not lower the high insulating efficiency of Eagle-Picher Blankets. Their principal ingredient, Eagle-Picher Mineral Wool, does not break down or deteriorate despite continuous exposure to temperatures as high as 1200 F. This physical and chemical stability enables Eagle-Picher Blankets to resist water, steam, moisture, corrosive fumes and normal vibration permanently. Complete technical and application data sent on request.

Let these Eagle-Picher products also save you money... power... time

Insulating Felts
Supertemp Block • Blankets
Loose Wool • Pipe Covering
Stalastic • Insulseal • Insulstic
Swetchek • Finishing Cements
Insulating Cements



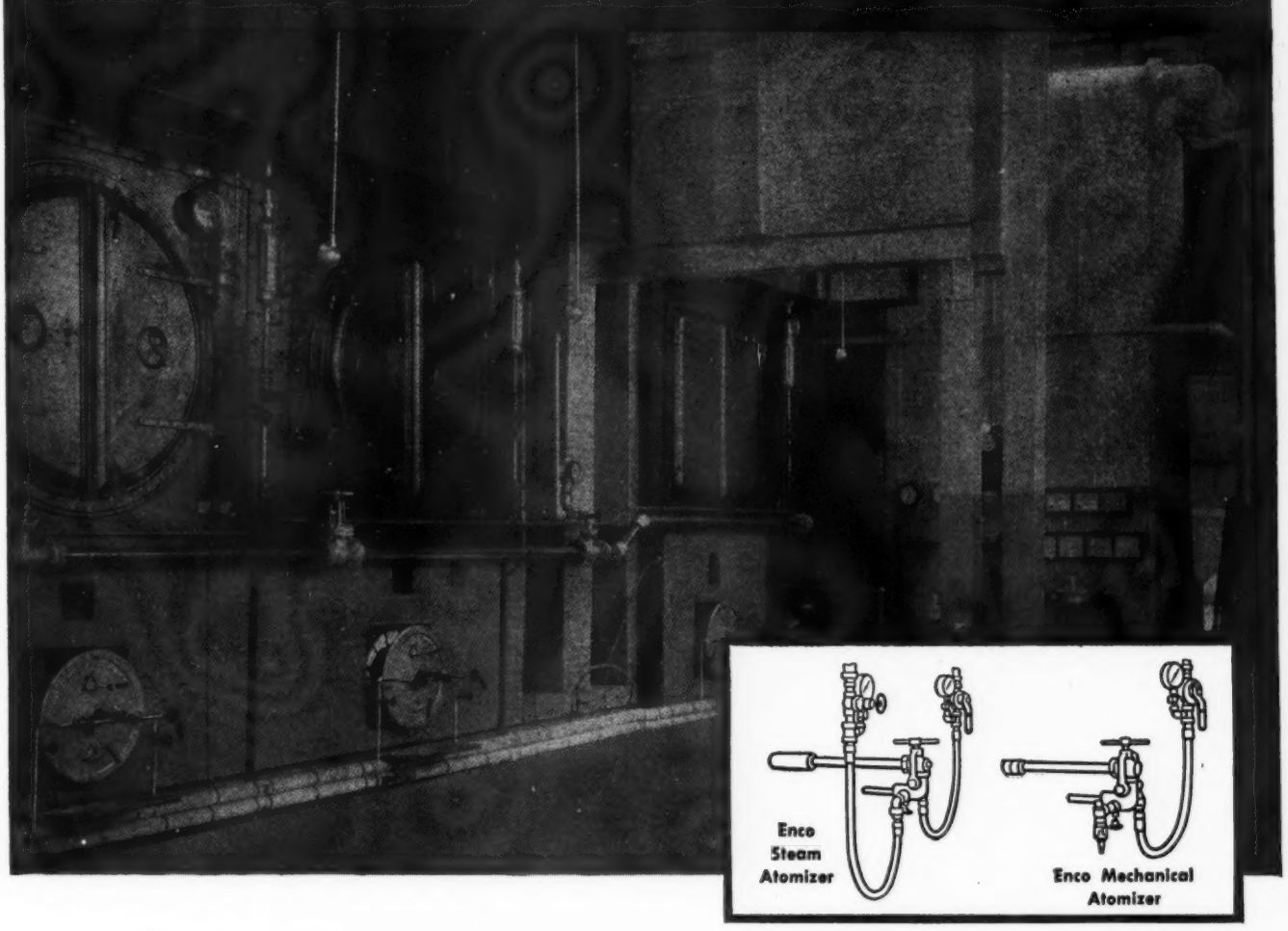
EAGLE-PICHER INSULATIONS for

EAGLE EP PICHER

High and low temperature

Since 1843
THE EAGLE-PICHER COMPANY
CINCINNATI (1), OHIO

Swinging Load Demands are Easily Met with ENCO OIL BURNERS



In power plants where steam demands swing from high peaks to low loads over short periods, burner tip changes often become a nuisance to the engineer . . . and a source of man-hour loss which soon shows up in over-all cost figures.

With Enco Wide Range Atomizers, this frequent changing of burner tips is eliminated.

Used with all grades of liquid fuels, Enco Atomizers are designed for instant change of guns for operation with either steam or mechanical system. They are made in various sizes with capacities from 10 to 1,000 gallons per hour.

Enco Atomizers are often used with various types of pulverized coal and gas-burning equipment to provide a dual fuel unit for cold starting, or for full-load operation, when other fuels are unavailable or are less economical than oil.

For 30 years, Enco Burners have been leading the way to more efficient, more economical boiler operation. Write today for further information, or see your local Enco Representative.

EC-471

THE ENGINEER COMPANY

Also Produces

Enco Streamline Baffles
Enco Oil and Gas Burning Equipment
Enco Fuel Oil Pumping and Heating Units
Enco Automatic Combustion Control

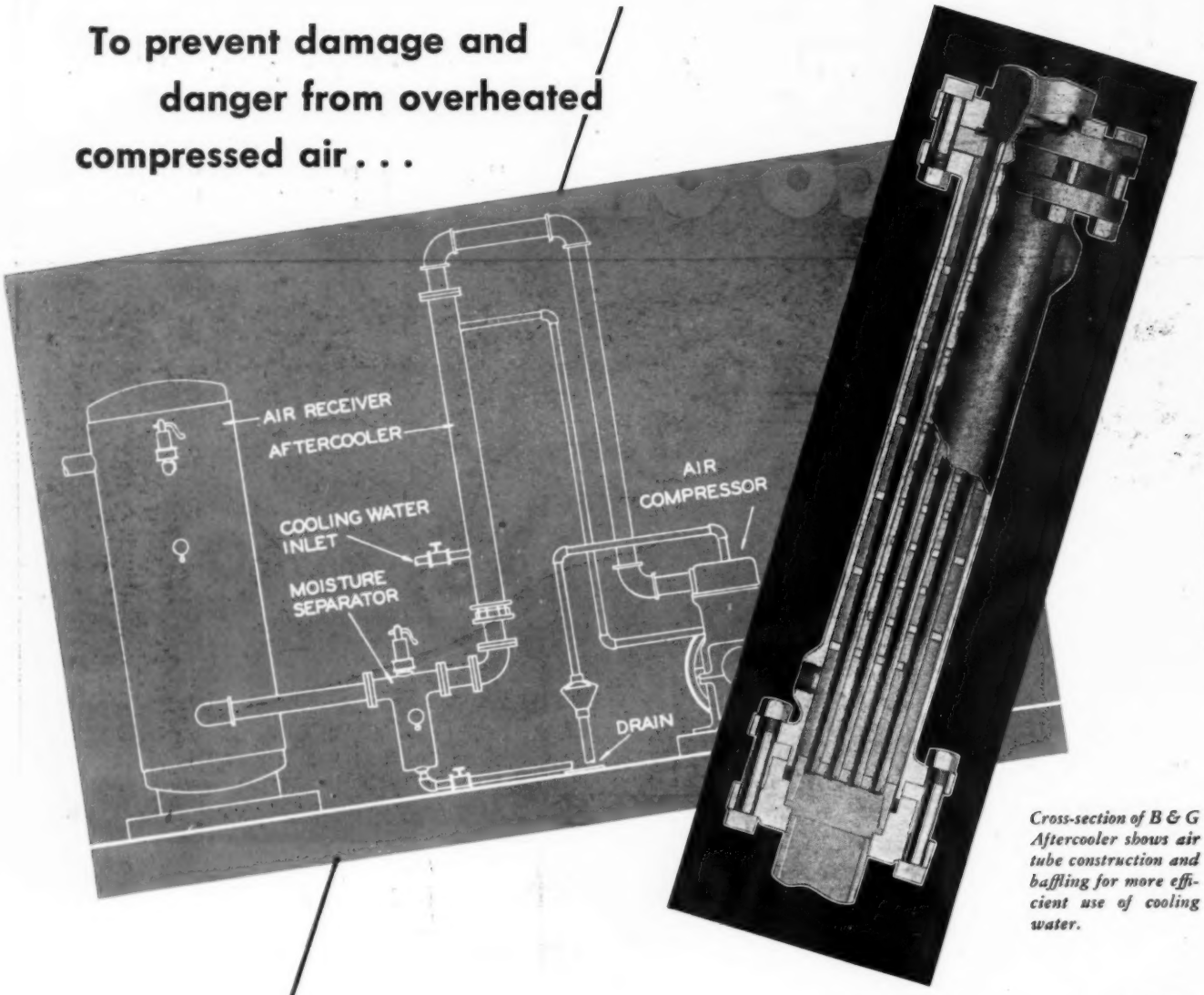
THE ENGINEER COMPANY

75 West Street, New York 6, N. Y.

Canadian Representative

F. J. Raskin Ltd., 370 Rachel E., Montreal, P. Q.

To prevent damage and danger from overheated compressed air . . .



Cross-section of B & G Aftercooler shows air tube construction and baffling for more efficient use of cooling water.

B & G AFTERCOOLERS

For processes where compressed air is used, a B & G Aftercooler is the sure way to protect against possible explosions and against oil and water damage to material and tools.

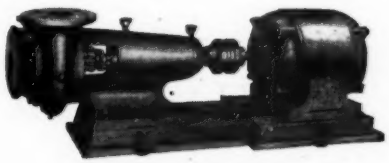
This safety device both *cools* and *dries* the air before it enters the pipe lines. To omit it is a standing invitation to equipment damage and personal injury.

B & G Aftercoolers are of the highly efficient "air tube" design (the air passes through the tubes and the cooling water around them), effecting more efficient use of the cooling surface and reducing pressure drop. More compact units and smaller cooling water requirements are results of this design.

These units have steel shells, giving greater strength against both pressure and rough handling. The flanges are extra heavy and the tube bundle may be easily removed for cleaning.

B & G SERIES OC-1 HEAT EXCHANGER

For heat exchange between liquids, this B & G unit has a wide range of applications. Sturdy, compact, easily cleaned.



B & G CENTRIFUGAL PUMPS

Available with semi-open or enclosed impellers —motors flexible coupled or integral with pump.

Send for descriptive literature

Hydro-Flo® PRODUCTS

BELL & GOSSETT COMPANY

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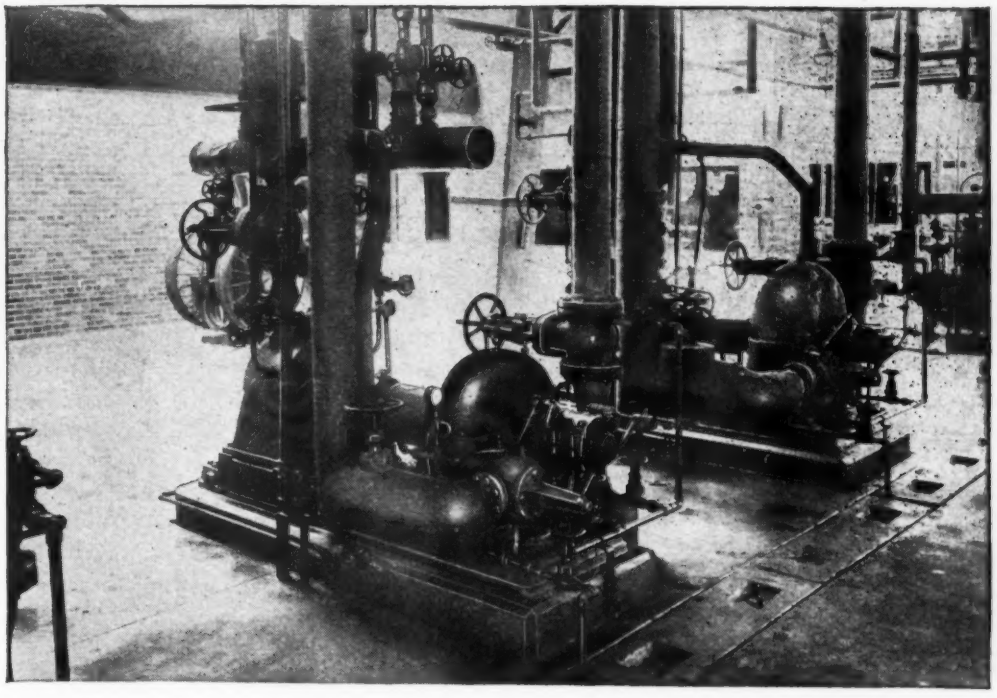
TERRY



THE ROTORS OF THESE 75 H. P. TERRY TURBINES ARE DOUBLE RIM PROTECTED

The two 75 H.P. Terry Turbines shown above (in the plant of a leading refiner) employ the Terry Solid Wheel Rotor. The wheel is made from a single steel forging and the buckets are milled directly into the wheel. — All as shown in the illustration at the left.

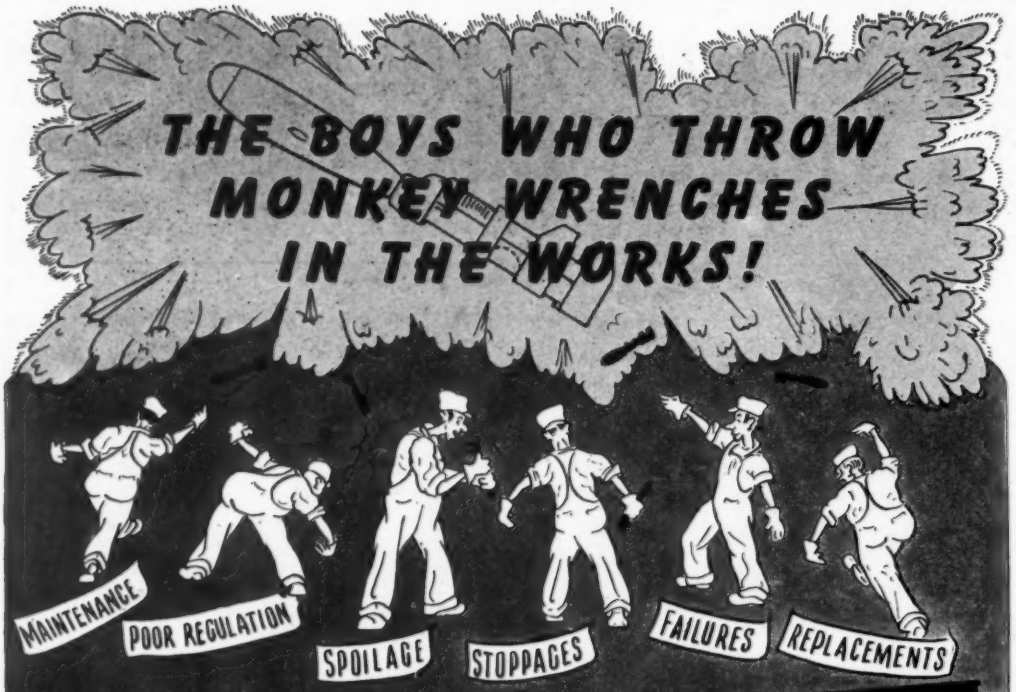
The buckets are protected by rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the clearance became reduced.

With this construction it is impossible for the blades to foul and frequent inspections of the thrust bearing are not required to obtain safe and dependable operation.

This feature and many others of the Terry Wheel Turbine are fully discussed in our Bulletin S-116.

T-1169

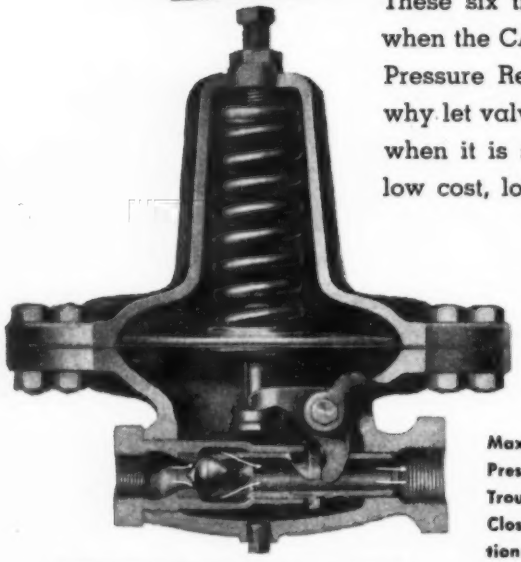
THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.



GET RID OF THEM WITH THE

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE

These six trouble makers can't jam up the works when the CASH STANDARD Streamlined Type 1000 Pressure Reducing Valve is on the job. Therefore, why let valves be a source of high costs and trouble when it is so simple to have smooth, dependable, low cost, long time "Streamlined" valve operation.



Bulletin 962 gives the complete story

This bulletin describes fully the Streamlined design of the "1000" valve which is the assurance of "no-trouble" performance. It gives you the reasons why you get such benefits as are listed in the paragraph directly below.

•

Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs

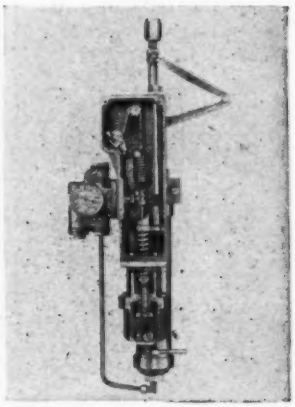
CASH STANDARD CONTROLS... VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

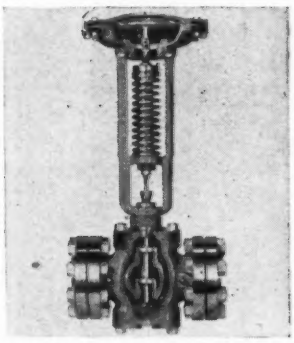
•

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

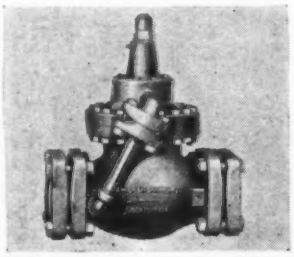
Send for them



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.



Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

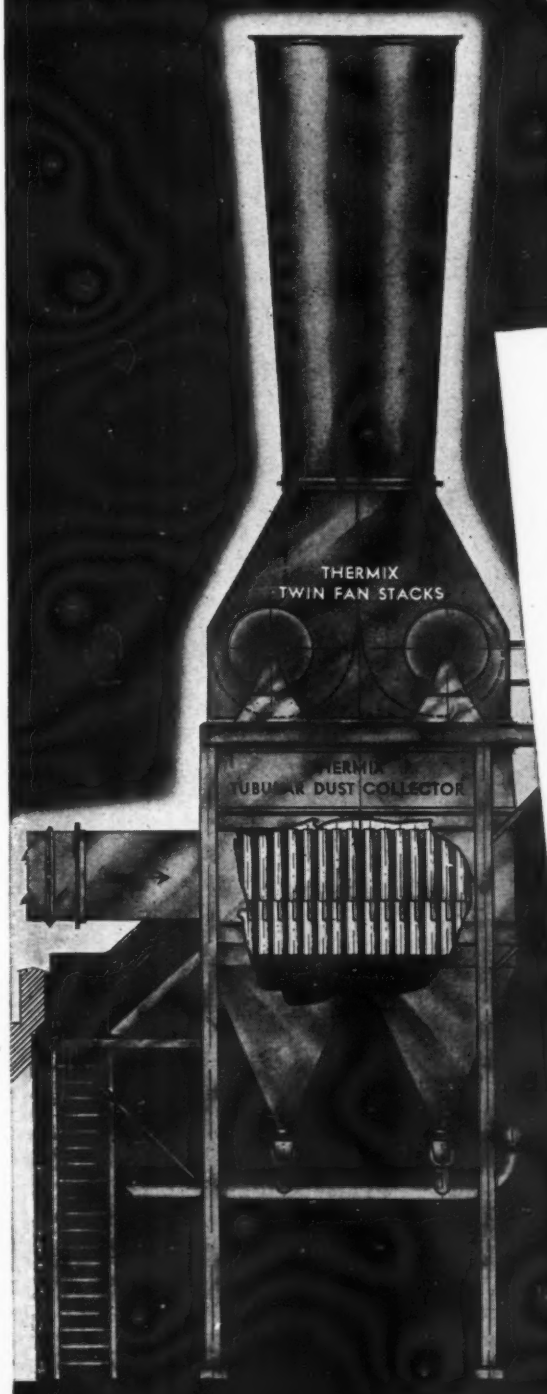


Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

The Atlas Powder Company

STAMFORD, CONNECTICUT PLANT

solved its summer-winter peak loads with THERMIX Induced Draft and Dust Collecting Equipment



At this plant there are 4 boilers. The winter peak is 120,000 lbs. of steam per hour from 2 or more boilers. In the summer, the peak is 60,000 lbs. of steam per hour from 1 or more boilers.

Space was at a premium because of adjoining building walls and the Draft and Dust Collector Equipment had to be placed in operation without any cessation of service of the steam plant.

To answer the summer-winter peak load problem, a Thermix twin fan (Type 1-A) stack was installed directly above a Thermix Tubular Dust Collector divided into two cells, each of which served a fan. Both fans were adequate for the winter peak load while one fan and one Collector section easily carried the summer peak load.

It was necessary to install and place the unit in operation without interruption of steam flow. The gas was temporarily allowed to continue its original flow through an existing brick stack while the new equipment was being installed and placed in service. This was accomplished with no interruption.

Problems such as this are often solved by the use of Thermix Equipment. This solution was engineered and designed by The Thermix Corporation project engineers and they will be glad to aid you in your search for more efficient draft producing methods.

All inquiries should be directed to

THE THERMIX CORPORATION

Project and Sales Engineers

FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

(Offices in 28 principal cities)

Equipment designed and manufactured by

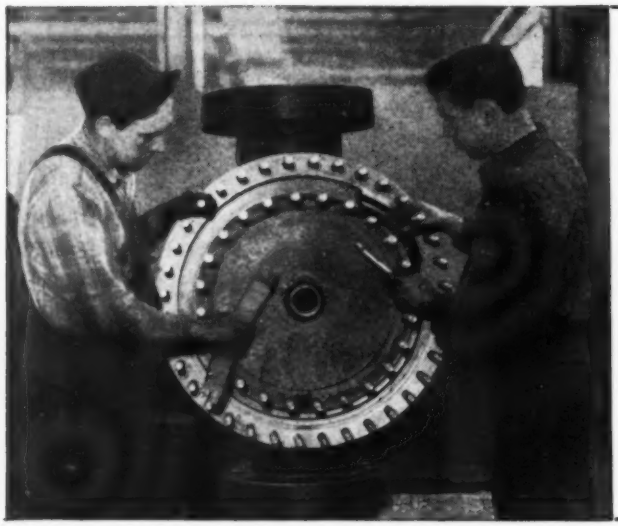
PRAT-DANIEL CORPORATION

Manufacturing Plant, EAST PORT CHESTER, CONN.

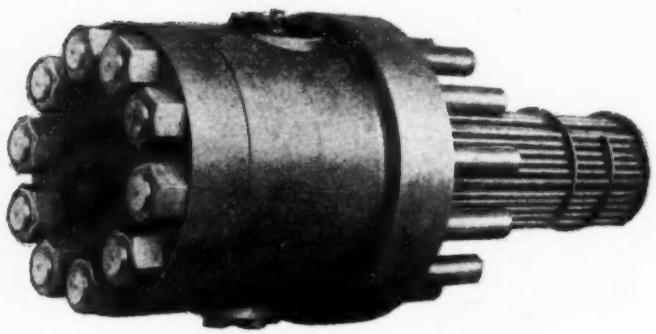
Compare MULTILOK*

with conventional closures

for HIGH-PRESSURE HEAT EXCHANGERS!

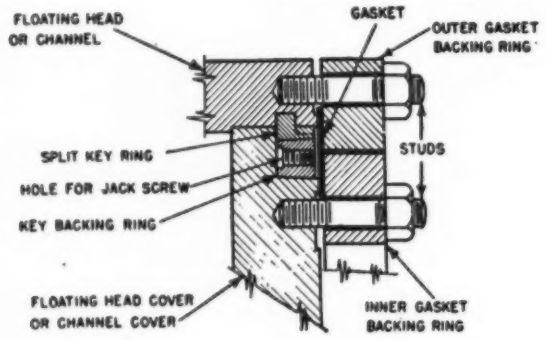


▲ *Multilok Closure*—Split key ring being installed.



Conventional Closure—Note heavy bolts and flange.

Typical Multilok Assembly ▼



Here you see two heat exchangers which were designed for comparable pressures. The closure of one is conventional. The other is Lummus' patented Multilok Closure.

With Multilok, no heavy, hard-to-handle bolting is required to hold the pressure. Thick, costly flanges are eliminated. It is to be particularly noted that gaskets are outside the head and can be set up or serviced without removal of head. Because of the accessibility and ease of servicing, replacement parts are seldom required.

Multilok Closures are used on both stationary and floating heads. They are used on feed water heaters, refinery, chemical, and general industrial high-pressure units.

Lummus heat exchangers are operating through wide temperature ranges and pressures varying from extremely high vacuum to 4000 psi. Conventional through bolting and backing ring construction is used for low and intermediate pressures; Multilok, for pressures of 750 psi and higher.

For utmost performance and minimum maintenance, let Lummus engineer your heat exchanger requirements.

*Trade-mark reg. U. S. Pat. Off.

THE LUMMUS COMPANY
420 Lexington Avenue, New York 17, N.Y.

LUMMUS

Atlanta • Boston • Chicago • Cleveland • Corpus Christi
Detroit • Houston • Fort Worth • Philadelphia • Pittsburgh
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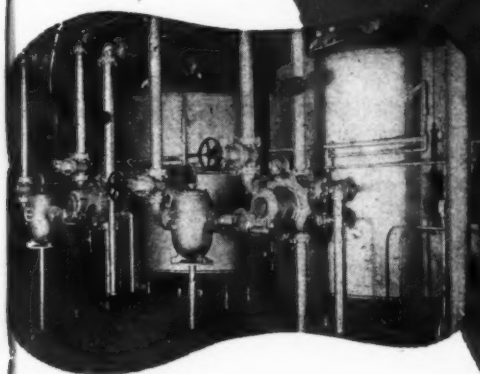
LOOK TO LUMMUS FOR: Heat Exchangers • Process Condensers • Reboilers • Steam Generators • Steam Jet Refrigeration Steam Surface Condensers • Barometric Condensers • Steam Jet Air Ejectors • Evaporators • Boiler Blowdown Heat Exchangers Fuel Oil Heaters • Lubricating Oil Coolers • Pipe Line Coolers • Feed Water Heaters • Jacket Water Coolers

"...d off my mind"



PERMUTIT ZEO-KARB* H WATER CONDITIONER removes both hardness and bicarbonates from water. Effluent contains no incrustants, is reduced in total solids and alkalinity. Alkalinity can be adjusted by mixing effluents from a Zeo-Karb H unit and a sodium zeolite unit.

*Trademark Reg. U.S. Pat. Off.

...osion
...ater
...lant is
...loads
...For,
...nd
...es

PERMUTIT

Manufacturers of ALL types of water treatment equipment

WATER COND... ...QUARTERS

"It's good business to begin with Good Water"

We left the toggles out--

and made a better clutch

To simplify means to improve. Again Dodge engineering "know-how" has applied basic principles to make a *great* improvement—the Rolling Grip Clutch. A circle of hardened steel balls, forced into a wedge-shaped groove by a sliding cam, develops the power-transmitting pressure on the friction disc. Cam and groove contours use the principle of the wedge to multiply the force exerted on the shifter collar into a much greater force on the friction disc.

Dodge Rolling Grip Clutches give outstanding flexibility and ease of control without any sacrifice of positive drive. Rugged, compact, easy to adjust and low in cost, this new Clutch is suited to a wide range of applications requiring from 1/2 H. P. to 20 H. P. at 100 R. P. M. Get the details now about this and other new developments by Dodge of Mishawaka to help you cut costs and increase production.

DODGE MANUFACTURING CORPORATION • MISHAWAKA, INDIANA

DODGE
of Mishawaka, Ind.

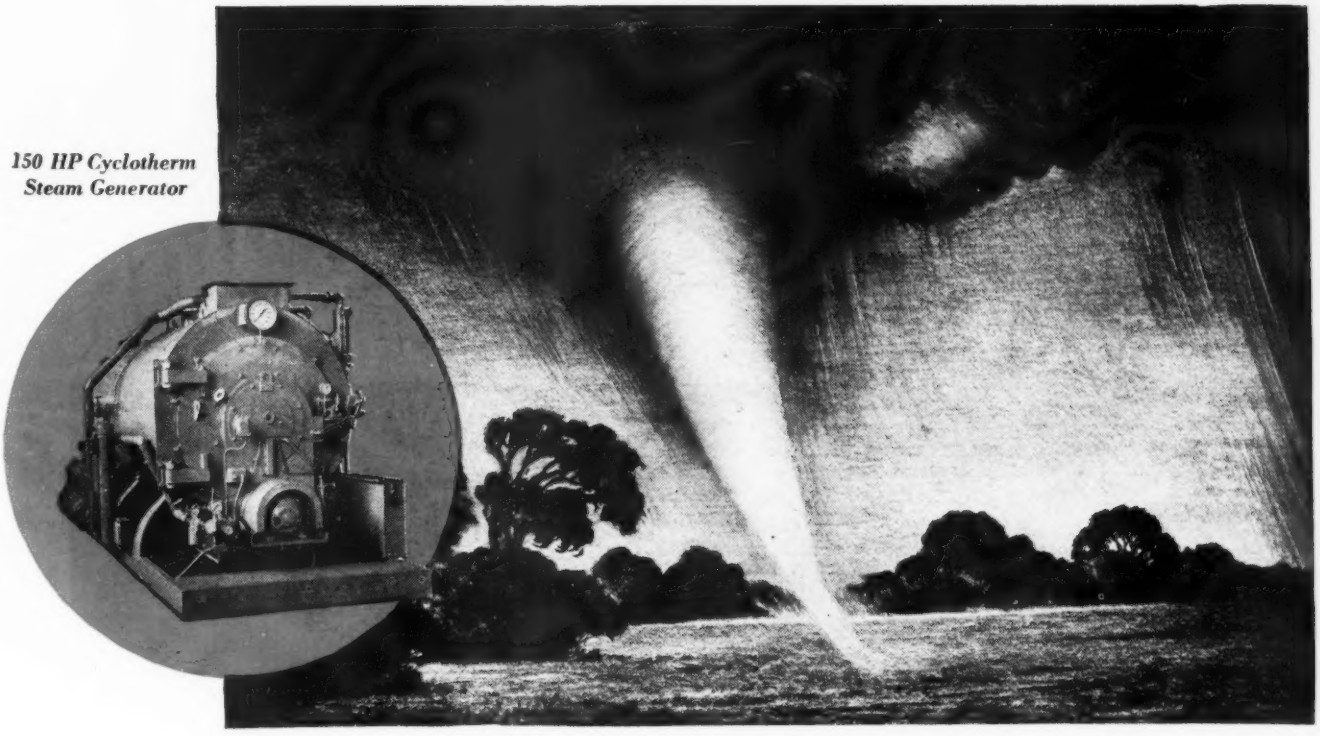
CALL THE TRANSMISSIONEER

He's a factory-trained specialist in the mechanical transmission of power, qualified to analyze your problems and suggest correct equipment. A talk with him will mean savings to you. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

Copyright, 1947, Dodge Mfg. Corp.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS



150 HP Cyclotherm Steam Generator

We Harness the Cyclone's Force

The furnace tube of a Cyclotherm Steam Boiler in operation houses a cyclone of fire—safely and automatically controlled. By applying to combustion the same principle that gives a ruthless "twister" its destructive power, Cyclotherm engineers offer the world a new and better steam boiler, one that does more efficient work for you at less cost than you have ever known.

The patented Cyclotherm method consists of burning the atomized fuel in a rapidly revolving cyclonic flame completely in the first pass. This highly radiant cyclone of flame travels relatively slowly through the length of the furnace tube with the result that heat is radiated intensely and uniformly.

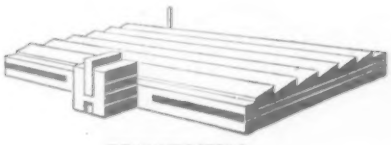
Cyclotherm units of 80 to 300 HP are equipped with an automatic modulating steam pressure control system which provides the proper quantitive fuel-air relationship for all firing rates with oil (or gas) and air pressure constant. Firing rates are modulated from 30% to 100% of rated capacity in response to steam demand. Units of 10 to 60 HP utilize the "on-and-off" method of operation which is immediately responsive to thermostat or pressure control and is more economical on small boilers. Both methods of firing are guaranteed 80% efficient.

Cyclotherm units are manufactured in sizes from 10 to 300 HP with operating pressures from 15 to 200 psi and a steam output of from 345 lbs. per hour from feed water at 212° F to 10,300 lbs. per hour. For greater steam requirements, a battery of Cyclotherms is recommended.

Prompt factory delivery assured.

For further information write for our specially prepared booklet 302Z

POWER



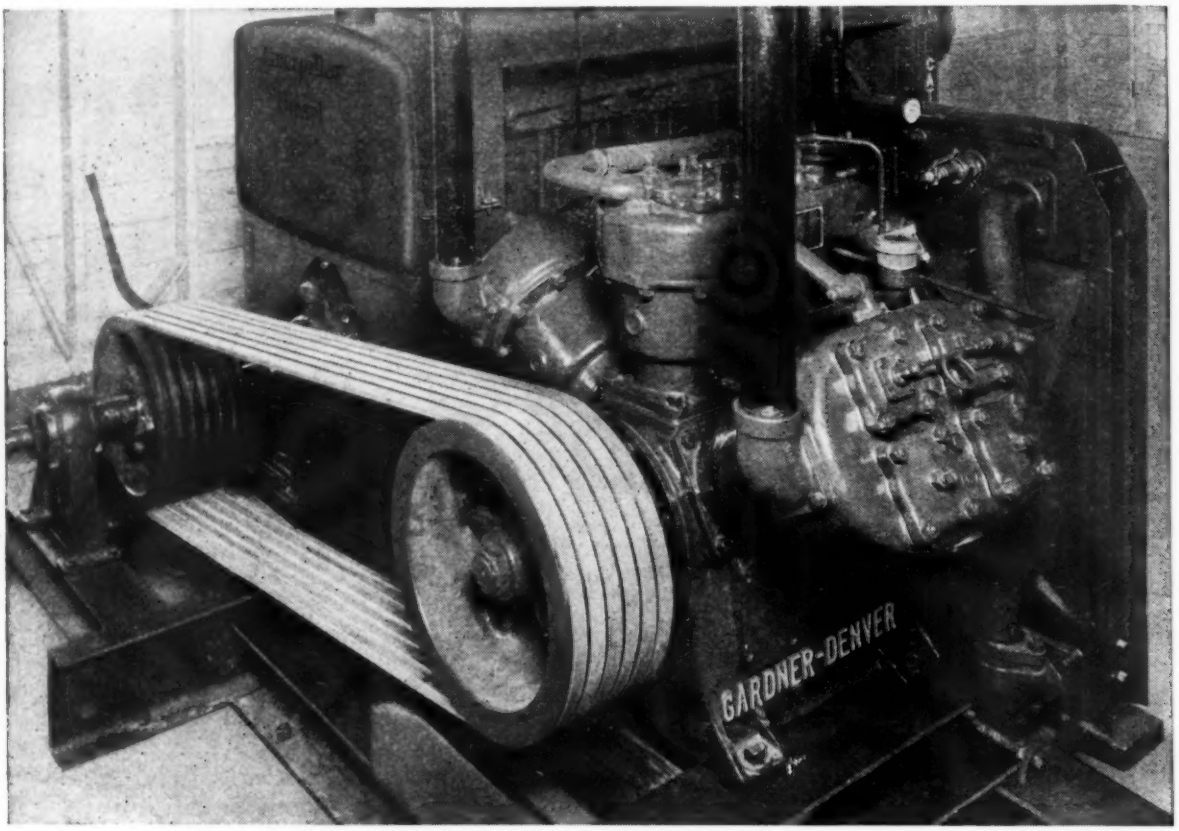
PROCESSING

HEATING

CYCLOTHERM STEAM GENERATORS

CYCLOTHERM CORPORATION, 90 BROAD STREET, NEW YORK 4, N. Y.

What do careful buyers know about this "WB" Compressor?



It's an open secret among buyers that Gardner-Denver Class "WB" Air Compressors, though compact in size and rated as "small machines," develop efficiencies comparable to those of large two-stage horizontal compressors! In other words, *you get more air output in less space — and at low cost.*

The reason? Class "WB" compressors are a departure from conventional design. The use of two small water-cooled cylinders where one large one is ordinarily used results in lower air temperatures — saving in horsepower — considerably reduced inertia load. Other "WB" features you'll value are:

- ✻ *Combination radiator and air-cooled intercooler permits use where cooling water is scarce or of poor quality.*
- ✻ *Completely water-jacketed cylinders for maximum operating efficiency in any temperature or at any altitude.*
- ✻ *Silent "cushioned" Duo-Plate valves.*
- ✻ *Positive pressure system of lubrication from oil pump.*
- ✻ *Timken tapered roller main bearings.*

For complete information, write
Gardner-Denver Company, Quincy, Illinois

USE COMPRESSED AIR FOR SAFETY CONVENIENCE FLEXIBILITY

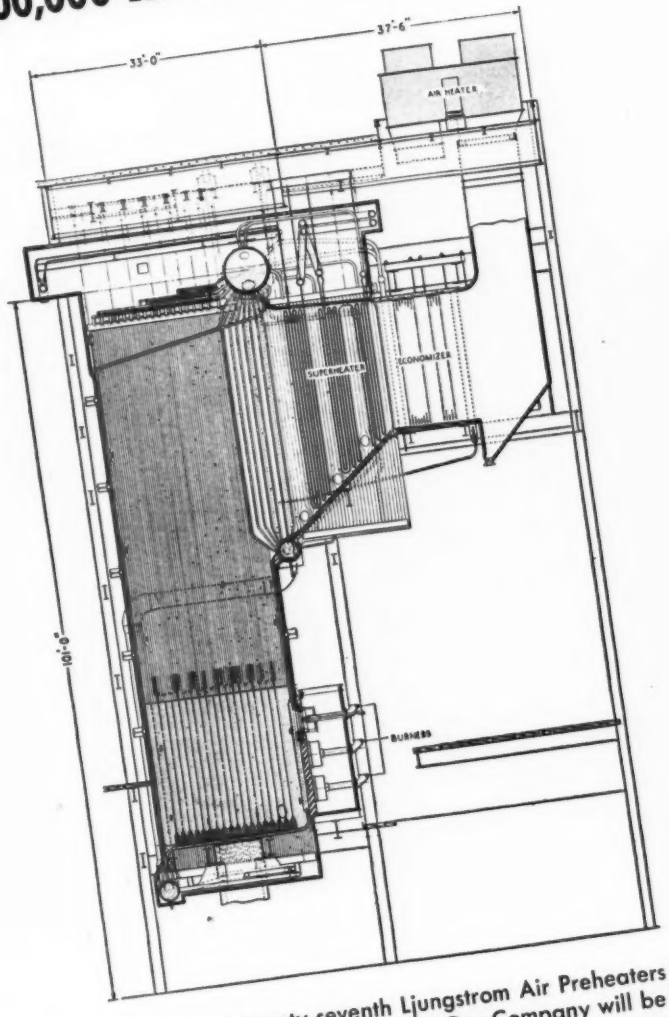
GARDNER-DENVER

SINCE 1859

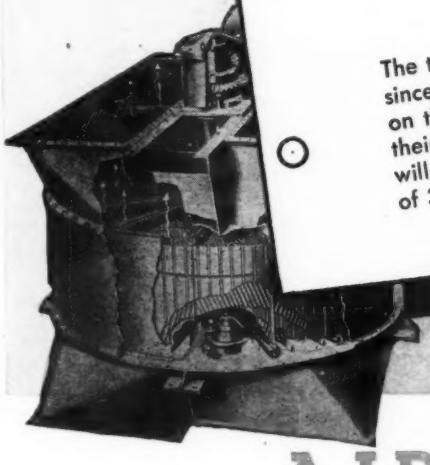
ENGINEERING PROGRESS REPORT #14

LJUNGSTROM AIR PREHEATER

NEW 1,000,000-LB. STEAM GENERATING UNIT



The twenty-sixth and twenty-seventh Ljungstrom Air Preheaters ordered since 1927 by Public Service Electric and Gas Company will be installed on the new 1,000,000 pounds per hour Babcock and Wilcox boiler in their Essex Generating Station at Newark, N. J. These two Ljungstroms will supply preheated air at 730 F. with full-load exit-gas temperature of 347 F.

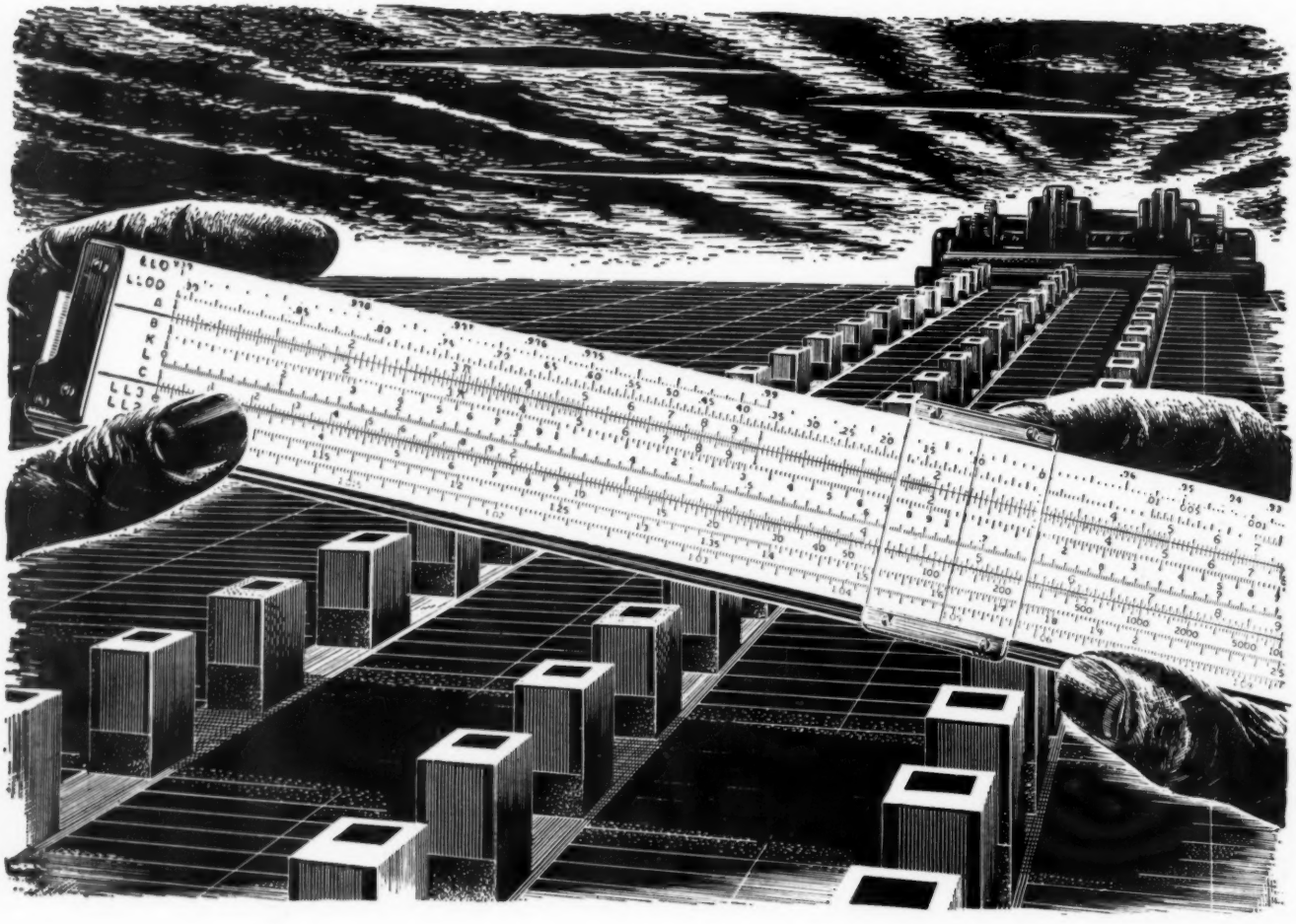


THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.



TRANE HEATING and AIR CONDITIONING -- Engineered Products for Engineered Systems

Complete air conditioning systems provide heating as well as cooling. More than that, they provide humidification, dehumidification, filtering, and air circulation. Obviously, no two applications require exactly the same combination of all of these functions . . . thus mass-produced air conditioning often provides too much of one factor and too little of another.

Architects, engineers, and contractors — who know that each job calls for a specially designed system — find their solution in the complete Trane line of heating and air conditioning products. They combine Trane engineered products — built with the economy of line production — into systems that meet exact requirements in every way.

Because Trane manufactures a *complete* line, architects, engineers, and contractors can plan entire Trane systems, obtaining all the necessary elements from one source, with one responsibility. Trane Field Offices in 85 principal cities offer these men their entire cooperation.

* * *

The Convector-radiator—modern successor to the old-fashioned cast iron radiator—has been engineered by Trane for universal application to steam and hot water heating systems, and is being produced in quantity so you can now secure it from local distributors' stocks.

TRANE

Manufacturing Engineers of Equipment for
HEATING AND AIR CONDITIONING

THE TRANE COMPANY, LA CROSSE, WISCONSIN • *Also* TRANE COMPANY OF CANADA, LTD., TORONTO, ONTARIO

Cooked to perfection

Welding, heating, bending, shaping — all tend to change the grain structure and character of metals, leaving weaknesses or locked-up stresses that inevitably show up in operation, unless counter measures are taken.

Studies conducted in the Kellogg Metallurgical Laboratories have uncovered astonishing and highly valuable data on why metals behave the way they do.

Based on this knowledge, vessels, and alloy piping particularly, are subjected to exact stress-relieving and heat-treating operations in the Kellogg shops — literally "cooked to perfection" — to assure greatest strength under actual operating temperatures, and to resist graphitization.

It's extra knowledge and *extra care* like this that accounts for the *extra quality* in a Kellogg job — the reason why so many of the world's top industries turn to Kellogg when perfection is all-important.

FABRICATED PRODUCTS DIVISION

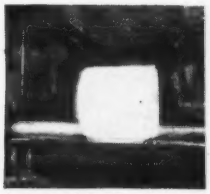
THE M. W. KELLOGG COMPANY

NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
TULSA • HOUSTON • TORONTO • LONDON • PARIS

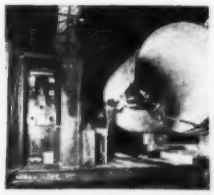
VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.



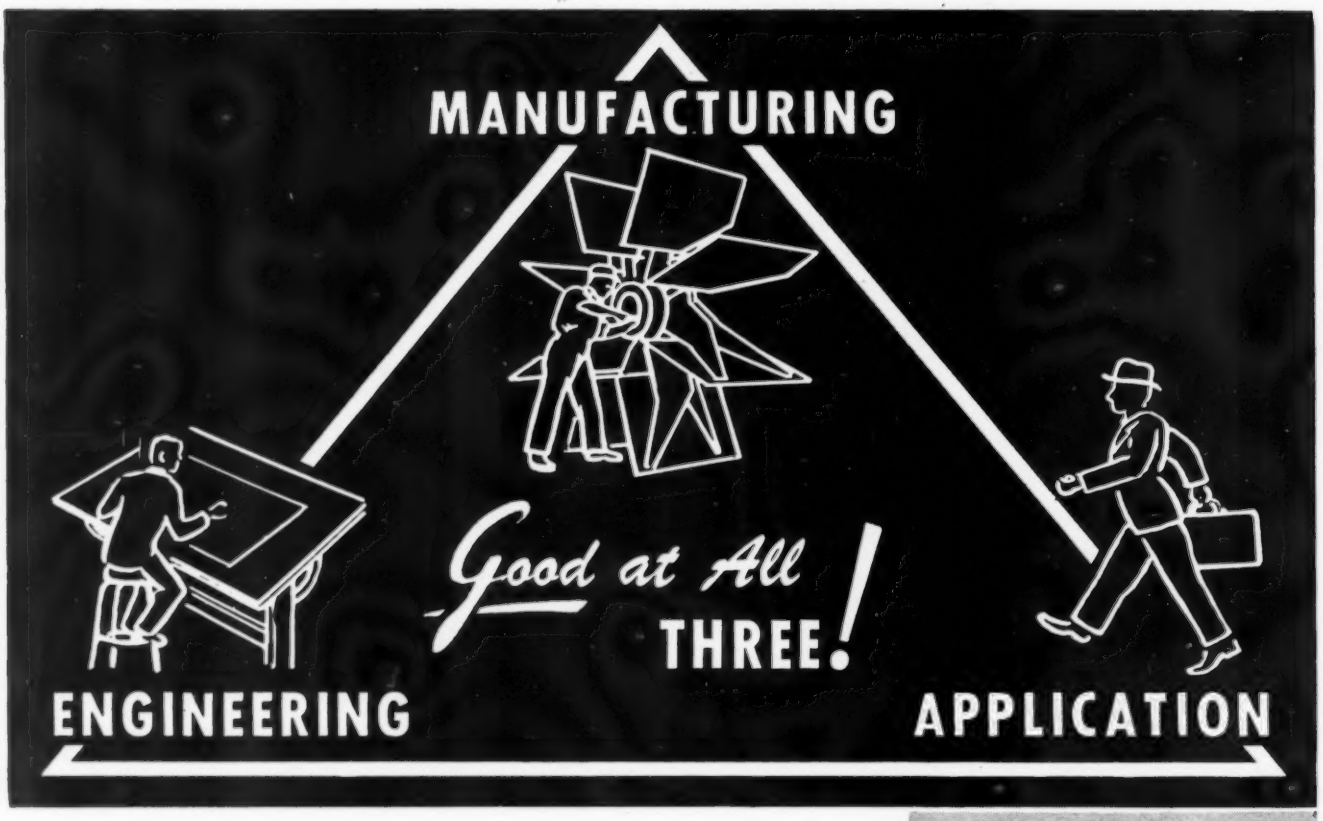
Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.



Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.

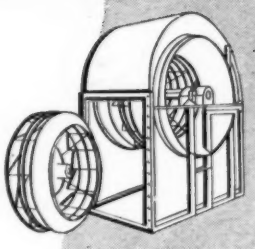
Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

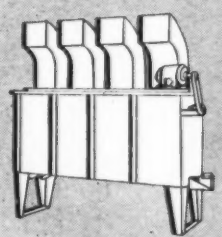


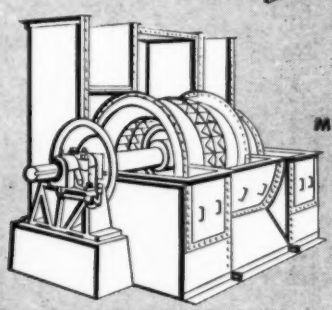
Take any type of air handling or conditioning requirement, and it makes sense to call in the nearest Clarage Application Engineer. This man KNOWS his business — can give you expert assistance.

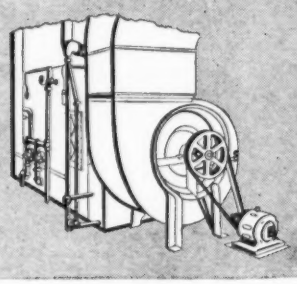
And back of his cooperation and recommendations are engineering resources and manufacturing skills unsurpassed in the fan industry. *Try Clarage for satisfactory results accomplished MORE economically.*

CLARAGE FAN COMPANY
Kalamazoo, Michigan
Application Engineering Offices in all Principal Cities


AIR FOR INDUSTRIAL PROCESSES

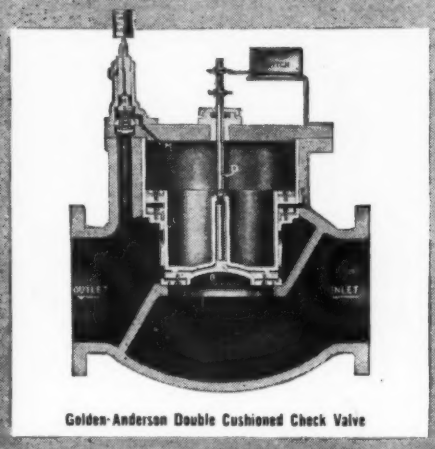

FACTORY AND SPACE HEATING


MECHANICAL DRAFT

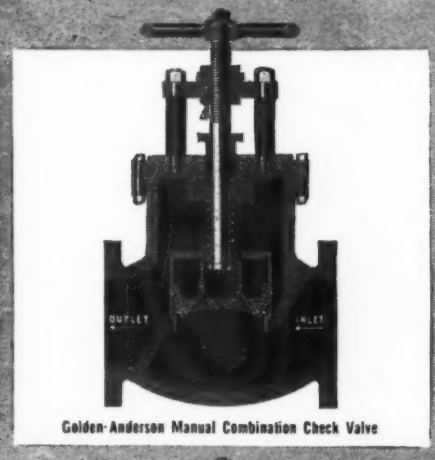

INDUSTRIAL AIR CONDITIONING

Clarage
—HEADQUARTERS FOR AIR HANDLING AND CONDITIONING EQUIPMENT

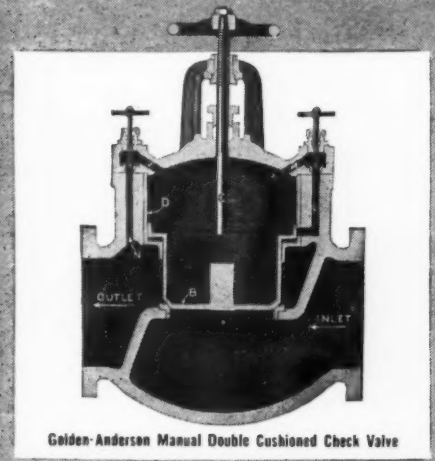
Golden-Anderson Standard Double Cushioned Check Valve



Golden-Anderson Double Cushioned Check Valve



Golden-Anderson Manual Combination Check Valve



Golden-Anderson Manual Double Cushioned Check Valve

THOUSANDS OF SAFE

"STOPS and STARTS"

day after day

hydraulic... automatic... manual

GOLDEN-ANDERSON

CUSHIONED

CHECK VALVES

Designed for safe, dependable control on the most difficult installation to eliminate serious surge and "Water Hammer"—to properly arrest reverse flow. GOLDEN-ANDERSON Cushioned Check Valves are specified on many of the most important new and replacement installations.

Write for informative technical catalog.

GA

GOLDEN-ANDERSON

VALVE Specialty Company

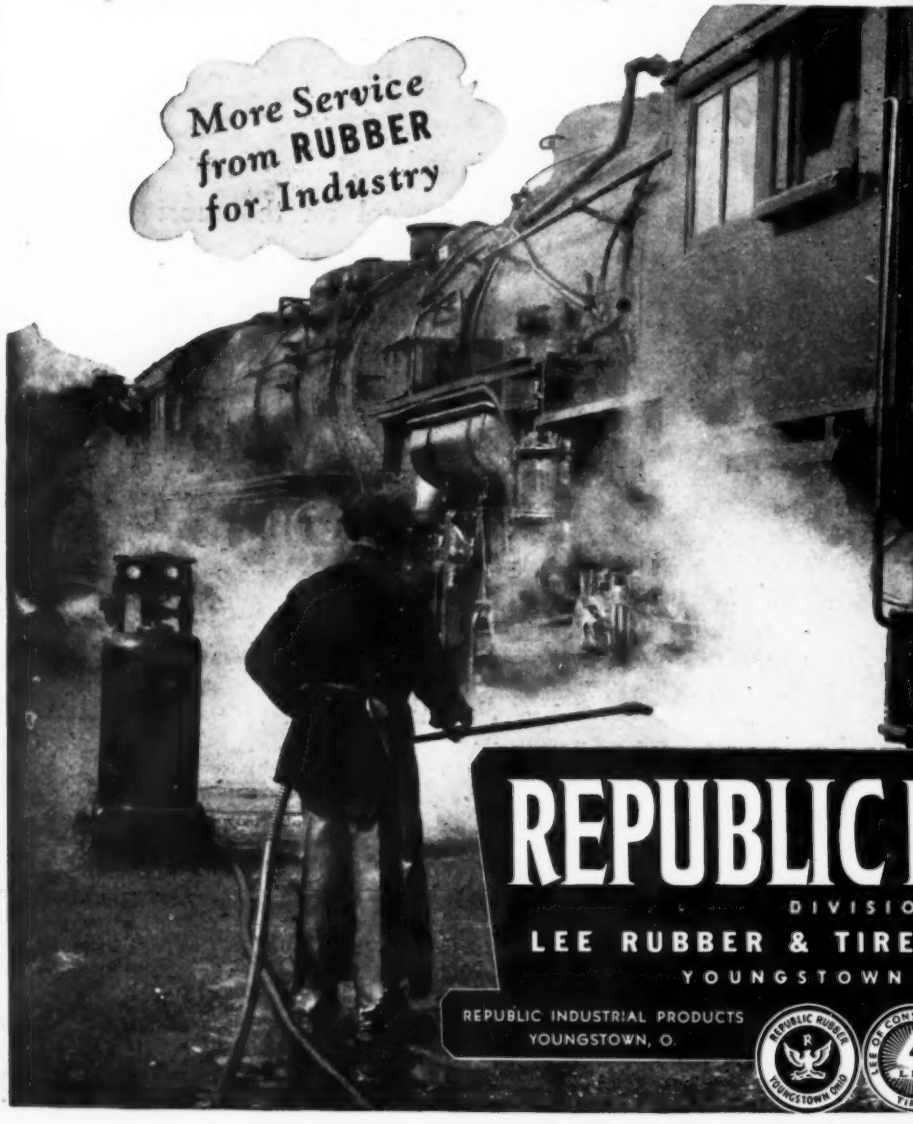
KEENAN BUILDING · PITTSBURGH 22, PA.

no Steam Bath
for Workmen

IT TAKES the peak safety factor built into Republic Steam Hose for complete protection of workmen against an unarranged steam bath. Live, high pressure steam, coursing through flexible conductors on pile driving, heating, fire fighting, cleaning and thawing operations, and other work, calls for greatest care in selection of the hose. Republic Hose is both built and sold for the specific job, on the basis of maximum working pressures. Each recommended construction incorporates the most advanced principles of design and highest quality materials, and is made with a functional strength far in excess of that required for the operating conditions. Under severest requirements, maximum safety is afforded by internal plies of asbestos cord and external, wire-wound protecting armor. Consult your Republic Distributor for this assured performance in Steam Hose or other Republic Belting and Hose.

1. Thick tube of special rubber compounded for high heat resistance and ability to retain flexibility.
2. Plies of strong, hard-woven duck, equalized by applying on a bias for maximum pressure resistance and insulated against heat by impregnation with special rubber.
3. Heavy, abrasion-resistant cover takes endless punishment and external wear.

More Service from RUBBER for Industry



REPUBLIC RUBBER
DIVISION
LEE RUBBER & TIRE CORPORATION
YOUNGSTOWN 1, OHIO

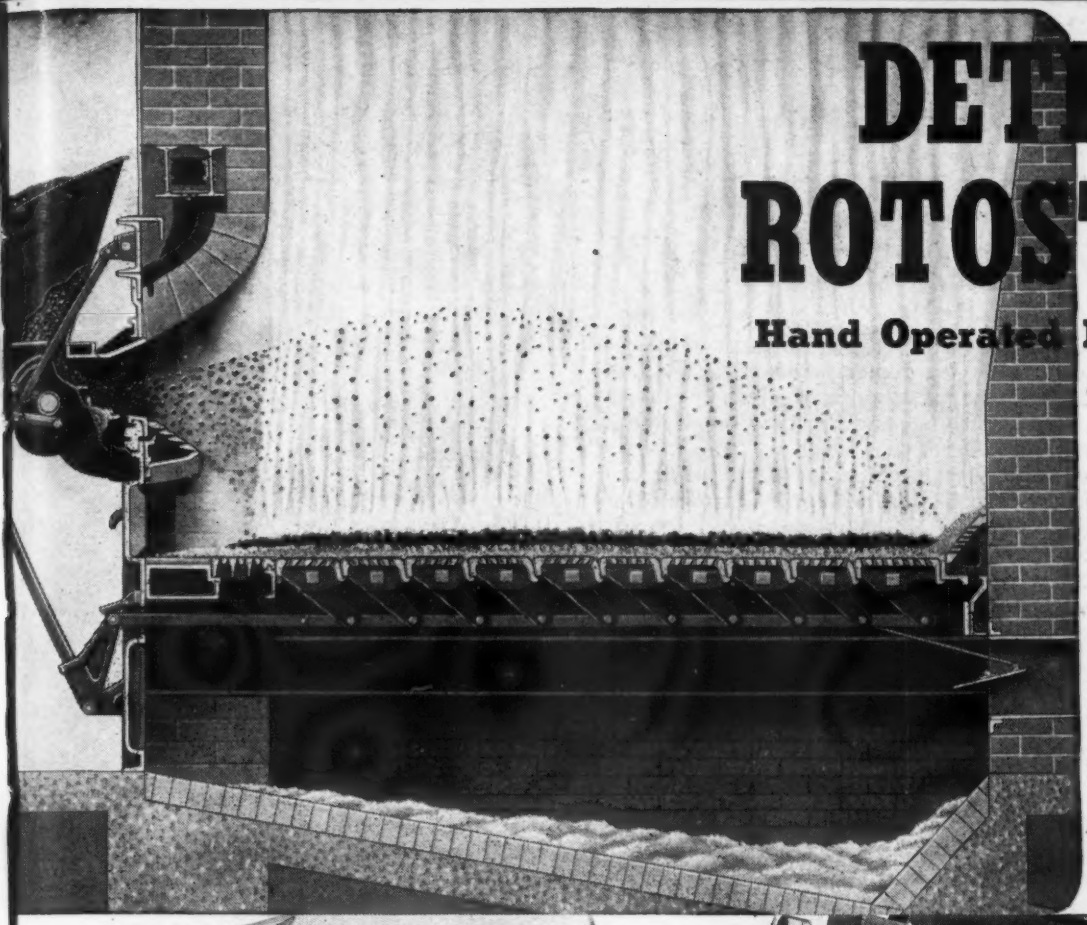
REPUBLIC INDUSTRIAL PRODUCTS
YOUNGSTOWN, O.

LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN, PA.

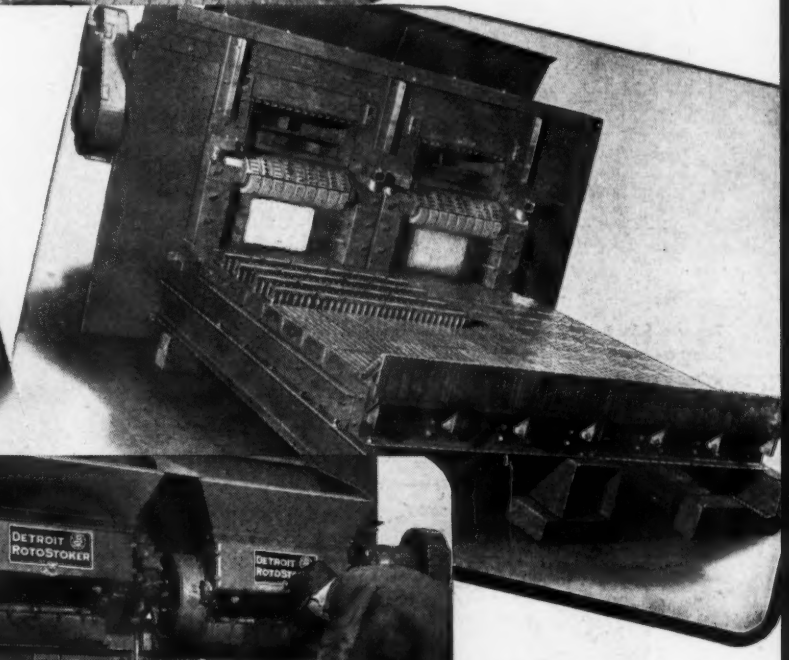
DETROIT ROTOSTOKER

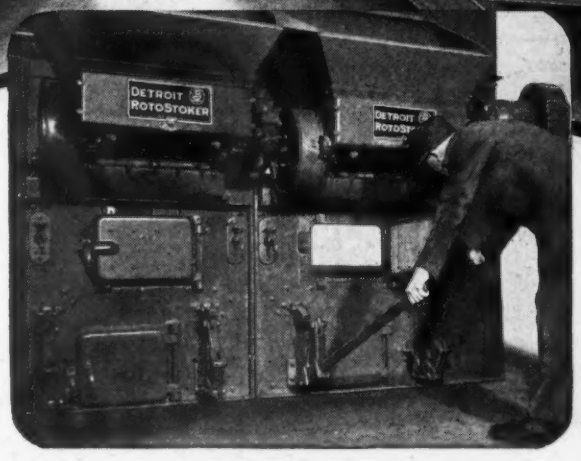
Hand Operated Dumping Grates

- OVERTHROW ROTORS FOR UNIFORM FUEL DISTRIBUTION
- FUEL AND AIR CONTROLLED—OPERATES WITH HIGH CO_2
- BURNS WIDE RANGE OF FUELS
- HANDLES FLUCTUATING LOADS
- COMPACT—SIMPLE DESIGN
- EASY TO OPERATE



Detroit RotoStoker ready for inspection and shipment.





Stoker grates cleaned by releasing dumping levers at front

DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Michigan • Works at Monroe, Michigan

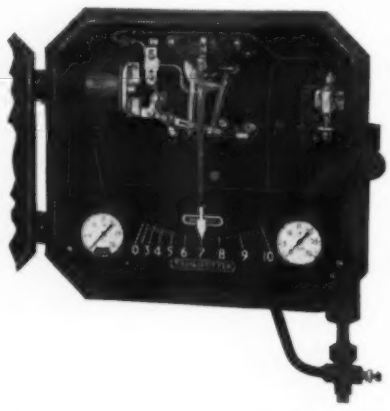
District Offices in Principal Cities • Built in Canada at London, Ontario

5 HITS - NO ERRORS

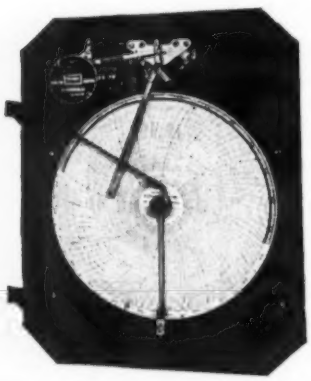
Taylor's Record at 1947 I. S. A. Show!

REMEMBER seeing these new Taylor Instruments at the I. S. A. Show? They're well worth looking at again now—because there's something *new* about each one. Each is an entirely new departure in precise industrial instrumentation. And that adds up to *increased production* efficiency — an effective defense against high labor and material costs. Along with our complete instrument line for indicating, recording and controlling in practically every industrial process, they're ready to help you keep quality up and costs down. Ask your Taylor Field Engineer — or write Taylor Instrument Companies, Rochester, N. Y., and Toronto, Ontario.

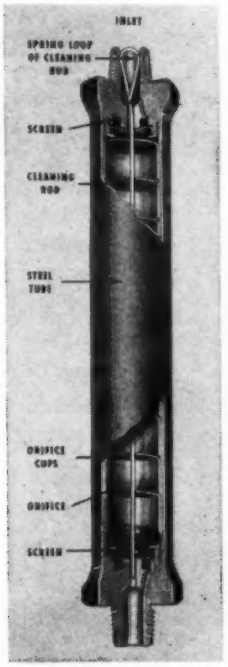
Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.



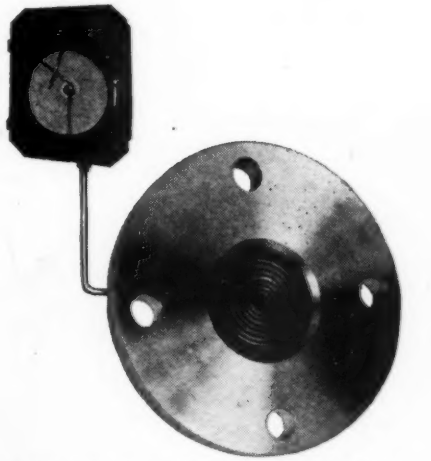
Taylor 226R Pneumatic Transmitter. Helps keep every process in your plant right under your finger tips. Accurate within ½ of 1% scale range. Gives you constant remote control of temperature, pressure, rate of flow and liquid level.



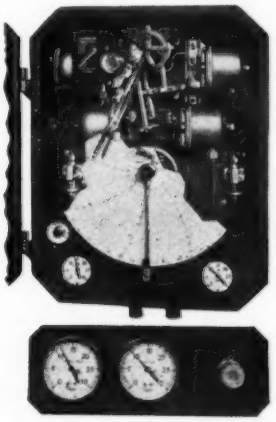
Taylor Square Root Integrator. Totalizes accurately the flow of liquids, and of gases and steam under constant pressure. Easy to read through 2 inch window in Recorder case door. Auxiliary scale and pointer for quick checking of calibration.



Taylor Pressure Pulsation Damping Unit. Damps pulsating pressure waves and gives you a *true instantaneous average of pressure.* Permits measuring instrument to make a clean-cut, easily interpreted pressure record. Makes instruments practical where they otherwise couldn't be used.



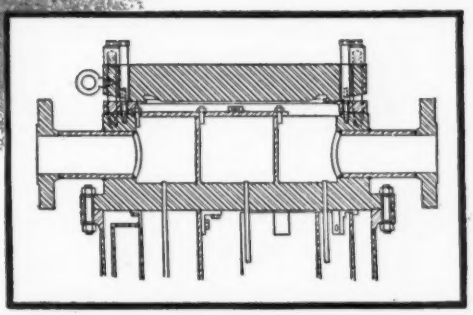
Taylor 229R Liquid Level Transmitter. Accurately measures the liquid level of slurries, soap, paper pulp, or any other viscous or corrosive liquids containing solids. Simple, highly responsive, built on force-balance principle. Ranges within 12 and 240 inches of water.

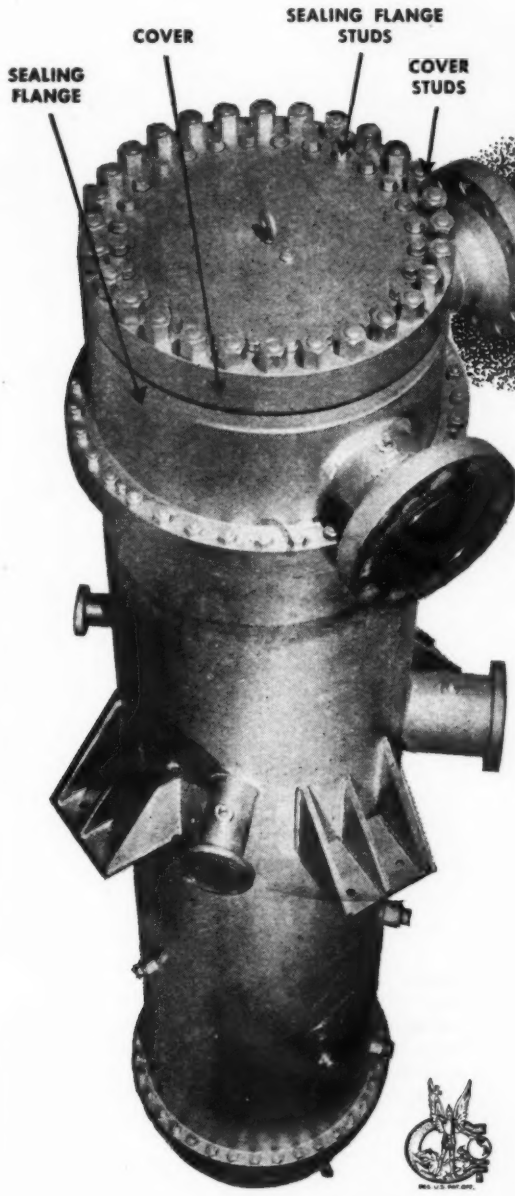


Taylor "Transet". New Pneumatic Transmission System for greater accuracy of control on applications with long lead lines between transmitter and control panel, and where compactness of control panel is a consideration for control of temperature, pressure, humidity, rate of flow and liquid level.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

A TIGHT HEAD-COVER JOINT
independent of main cover bolting and hydraulic load





IN THIS G-R EXTRACTION STEAM HEATER

No excessive wrench pull on the nuts is required to assure complete tightness of the head-cover joint gasket in the G-R Type Y Extraction Steam Heater.

This design has a separate sealing flange with an expansion member welded at its inner periphery to the cover. The cover carries the hydraulic load, and the sole function of the sealing flange is to provide only the necessary gasket contact pressure. The sealing flange is secured to the water head barrel by small studs with long nuts carried to the outside of the cover.

An additional advantage of the design is that the gasketed joint is visible, insuring immediate detection of any leak; and adjustment can be made without removing the head cover.

This is but one of the many distinctive features of G-R Extraction Steam Heaters. These heaters—available in a range of types for every pressure and capacity—are fully described in Bulletin 278 which will be sent on request.

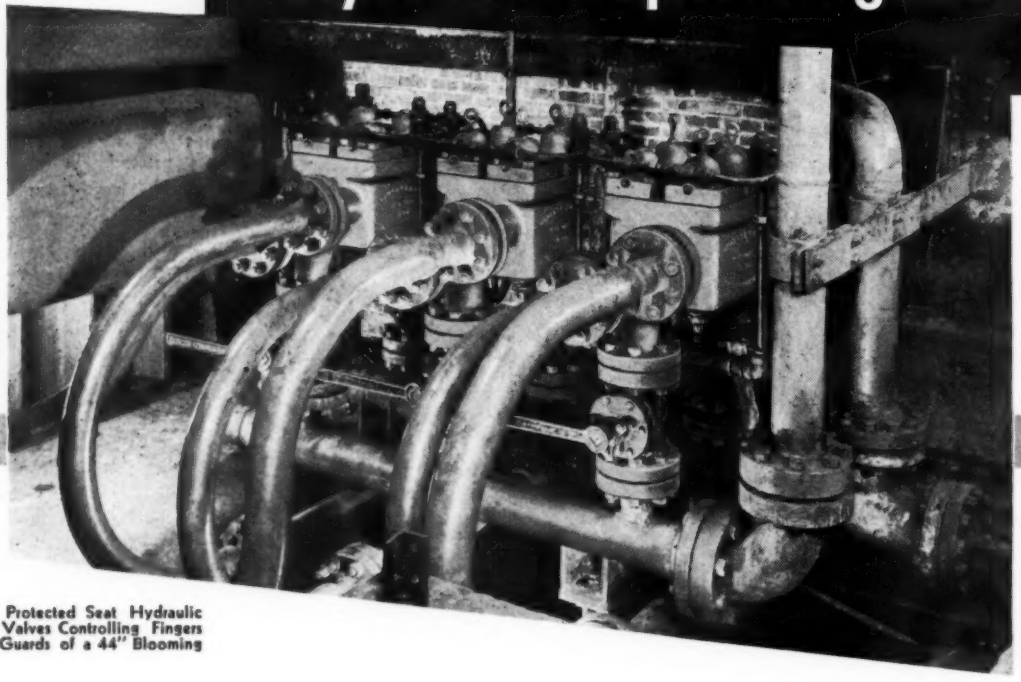
THE GRISCOM-RUSSELL CO.
285 Madison Avenue • New York 17, N. Y.

GRISCOM-RUSSELL
Pioneers in Heat Transfer Apparatus

FAST...SMOOTH...ACCURATE...DEPENDABLE

and 75% less expensive to maintain

HOMESTEAD PROTECTED-SEAT Hydraulic Operating Valves



4" 4-way Protected Seat Hydraulic Operating Valves Controlling Fingers and Side Guards of a 44" Blooming Mill.

THESE valves are used the world over in mills and metal working plants for the control of presses, stampers, furnace doors, manipulators, soaking pit covers, shears, ingot strippers and other hydraulic equipment. Their fast, smooth, accurate, dependable operation is assured by an exclusive, built-in feature, the Homestead "protected-seat."

The "protected-seat" consists of a closely fitted sleeve and an inside plunger which reduce fluid flow to a low velocity trickle while the seat and disc are still widely separated, thus eliminating "wire drawing" or cutting of the seat and resulting leakage and piston "slip."

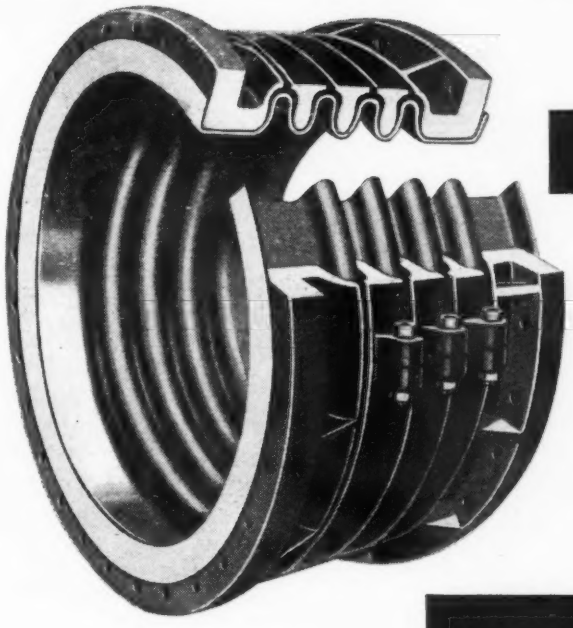
Maintenance costs are extremely low. Records of twelve to eighteen months continuous service without so much as the replacement of a fiber disc are common.

We will be glad to send you complete details and a copy of Valve Reference Book No. 38 without obligation. Why not write today?

Homestead Protected-Seat Hydraulic Operating Valves are made in 3-way or 4-way types, or in single poppet types to control hydraulic spray for descaling; sizes ½" to 4", hand or remote control, for pressures up to 3000 pounds.

HOMESTEAD VALVE MFG. CO.

P. O. BOX 210 CORAOPOLIS, PENNSYLVANIA



ALL-CURVE CORRUGATIONS

and

DIRECTED FLEXING EQUALIZING RINGS

MEAN EVEN DISTRIBUTION OF STRESSES . . . LONGER LIFE

E. B. Badger & Sons Company is the original and sole manufacturer of BADGER Expansion Joints

1. Corrugations in ALL-CURVE design to prevent localizing of stresses.

2. DIRECTED FLEXING Rings (patented), also in ALL-CURVE design, to equalize stresses among the corrugations and also within each corrugation.

3. One-piece construction to eliminate packing maintenance, manhole construction and tunneling expense.

4. Special forming methods to avoid structure-weakening forming stresses.

5. Special heat-treatment to preserve flexing qualities.

6. Compact design to require no more space than a regular flanged fitting.

There you have six great features that leave no doubt as to which is the strongest, surest acting, longest lived, most economical and most easily installed high-pressure and high-temperature pipe expansion joint offered.

Badger Packless DIRECTED FLEXING Corrugated Expansion Joints are built with *known factors* that leave nothing to guesswork. You can readily determine the number of corrugations needed, since the maximum traverse per corrugation is consistent for each size. For example:

Diameter	*Depth of Corrugation*	*Traverse per Corrugation*
4" and 5"	1⅛"	5/16"
6"	1¾"	½"
8" and 10"	2¼"	5/8"
12" and larger	2¾"	¾"

MADE IN COPPER, STAINLESS STEEL AND OTHER ALLOYS — Copper for normal pressures and temperatures; Stainless Steel and other alloys for higher requirements—and where corrosion is a problem. Single or multiple corrugations—for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require added protection. SEND FOR BULLETIN No. 100 *(Self-equalizing)* or No. 200 *(Non-equalizing)*.

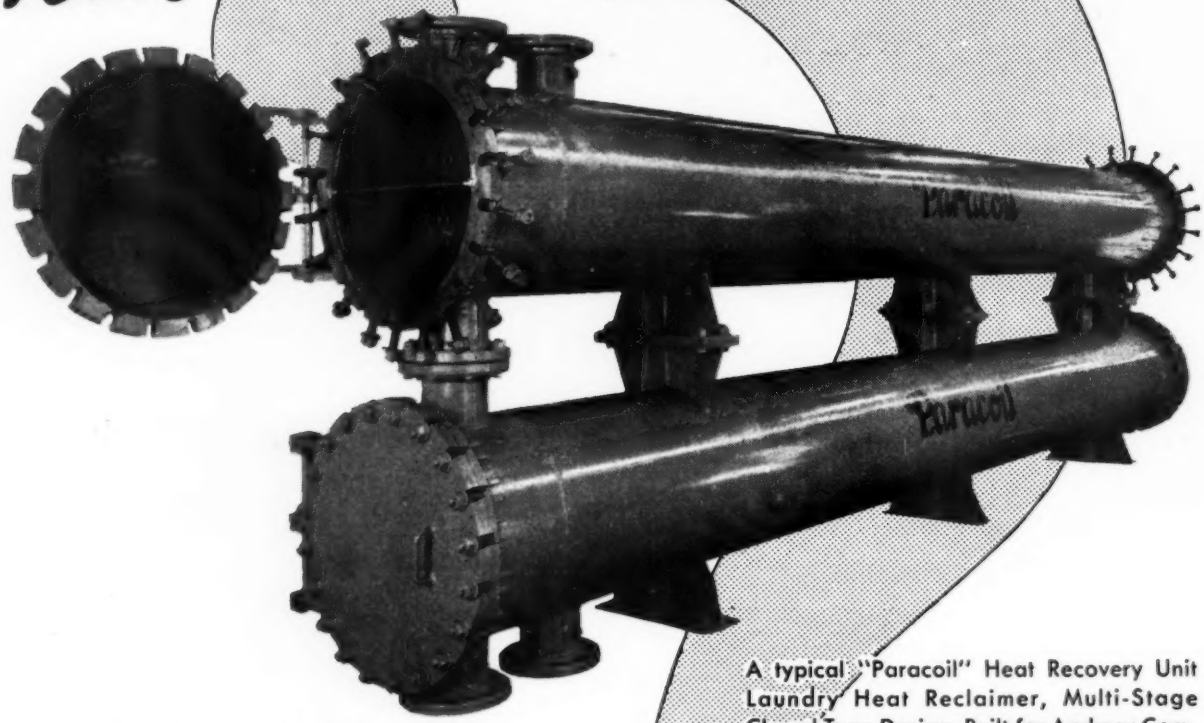
Badger

E. B. BADGER & SONS CO., 75 Pitts St., Boston 14, Mass.

AGENTS IN PRINCIPAL CITIES

PACKLESS CORRUGATED EXPANSION JOINTS

What Price B.T.U.



A typical "Paracoil" Heat Recovery Unit Laundry Heat Reclaimer, Multi-Stage Closed Type Design. Built for Andmar Company, Engineers, New York.

Every steam plant in America—regardless of size and type, or nature of fuel—is faced with the certainty of rising fuel costs. Increased labor charges at mine and well, coupled with higher railroad and marine transportation tolls, indicate an inevitable upward trend in the cost of B.T.U.'s delivered.

PARACOIL HEAT EXCHANGERS have been fighting this tendency for years, by reducing fuel costs through recovery of waste heat. Wherever hot liquids or gases are being allowed to go to waste, there "PARACOIL" can do a fuel saving job, often at remarkably low initial cost.

"PARACOIL" EXCHANGERS for Waste Heat Recovery are available as:

BOILER BLOWDOWN EXCHANGERS · DIESEL EXHAUST GAS WASTE HEAT BOILERS* · WASTE CONDENSATE COOLERS LAUNDRY WASH-WATER RECLAIMERS · FEED WATER HEATERS PROCESS WASTE HEAT RECLAIMERS · LIQUID TO LIQUID EXCHANGERS · GAS TO LIQUID EXCHANGERS

*For those particularly interested in the recovery of waste heat in Diesel Engine Exhaust Gases, we have available our BULLETIN NO. 301. Copies will be sent to anyone writing on his company letterhead. We *solicit your inquiries.*

DAVIS
ENGINEERING CORPORATION
1064 East Grand Street, Elizabeth 4, N. J.
SAVE WITH "PARACOIL"

FOR TROUBLE-FREE WIRE PERFORMANCE

125 Permanently Insulated ROCKBESTOS Wires, Cables and Cords

From the three basic designs illustrated Rockbestos has developed a complete line of 125 failure resisting wires, cables and cords, a few of which are described. All have the same performance guaranteeing characteristics detailed below. Write for information or samples.

Rockbestos Permanent Insulation Insures Long-Lived Service

1. A tough impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease, alkalies and corrosive fumes.
2. Felted asbestos insulation impregnated with heat, flame and moisture resisting compounds will not dry out with age, burn, or bake brittle under high temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance — protected from heat, flame and oxidation by felted asbestos walls.
4. Impregnated asbestos insulation that withstands heat of overloads and aging and won't become brittle, crack, rot or burn.
5. Conductors are perfectly centered in helically applied non-flowing insulation and will always remain so.

ROCKBESTOS 300 VOLT HEAT RESISTING FIXTURE WIRE
(Underwriters' Type AF)

Sizes No. 10 to 18 AWG stranded plain copper conductor insulated with black or white impregnated felted asbestos—with or without braid.

Rockbestos asbestos insulated fixture wires, approved by the Underwriters' Laboratories for lighting fixture wiring, will not bake out under the high socket temperatures developed in modern high-wattage fixtures. Also used for small motor and apparatus leads, switchboards, etc.

ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(National Electrical Code, Type AVB)

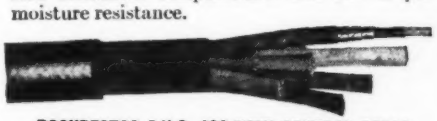
Sizes No. 18 to No. 4/0 AWG with varnished cambric and impregnated asbestos insulation and gray, black, white or colored flameproof braid.

Combine fire insurance and fine appearance in your switchboards with flame and heat resistant Rockbestos A.V.C. Switchboard Wire. Takes right angle bends without cracking because asbestos wall acts as a cushion beneath braid. Rockbestos A.V.C. Hinge and Switchboard Bus cables have same characteristics.

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA)

Sizes No. 18 AWG to 2,000,000 CM insulated with laminated felted asbestos, varnished cambric, and asbestos braid. Other constructions for service voltages to 5000.

This cable is recommended for power leads of heat-exposed equipment and circuits that run near boilers, steam lines, furnaces, kilns and other hot spots. It withstands high ambient and conductor temperatures and has ample moisture resistance.



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors with individuals insulated like Motor Lead Cable, cotton braid covered and cabled with an asbestos braid over all. Standard strandings AWG No. 12—19/#25 and No. 9—19/#22. Other strandings on order.

Designed for applications requiring a multi-conductor control cable capable of withstanding high temperatures, corrosive fumes, oil, grease and moisture. It also eliminates fire hazard as it will not burn. Used by equipment manufacturers, power companies, steel mills.

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(National Electrical Code, Type AVA)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard around furnaces, ovens, lehrs, soaking pits, boilers, etc., this permanently insulated wire is ideal. It won't bake brittle, crack, rot, flow or swell.

ROCKBESTOS THERMOSTAT CONTROL WIRE

Sizes No. 14, 16 and 18 AWG in two to five conductors with .012½", .025" or (for 115 volt service) .031" of impregnated felted asbestos insulation and steel armor.

A multi-conductor wire for fuel burner controls, safety pilots, intercommunications and signal systems. Heatproof, fireproof insulation and steel armor give trouble-proof circuits.

ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE
(National Electrical Code, Type AVA)

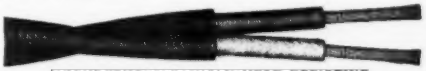
Size No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated asbestos and a high-dielectric varnished cambric insert, with a heavy asbestos braid overall.

Use this apparatus cable for coil connections, motor and transformer leads exposed to overloads or high ambient temperatures. It makes a permanent installation as it is resistant to heat, flame, oil, grease and moisture.

ROCKBESTOS ASBESTOS INSULATED MAGNET WIRE

Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

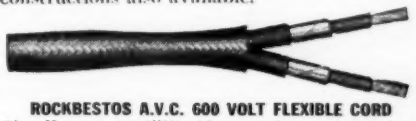
Protect motors against heat-induced breakdowns with Class B windings of heat resisting magnet wire. Rockbestos A.V.C. Motor Lead Cable completes the failure-proofing.



ROCKBESTOS 300 VOLT HEAT RESISTING DUPLEX FLEXIBLE CORD
(Underwriters' Type AFPD)

Sizes No. 10 to 18 AWG stranded plain copper conductors insulated with impregnated felted asbestos, polarized, twisted together and covered with a cotton braid.

This heat-resisting cord is approved for use in lighting fixtures and is recommended for pendant types as it does not dry out or crack at the socket. Also on apparatus and appliances which develop heat in operation or are used in hot, dry places. Twisted pair, tripled or triplex constructions also available.



ROCKBESTOS A.V.C. 600 VOLT FLEXIBLE CORD

Sizes No. 10 to 18 AWG with two or three conductors insulated with impregnated felted asbestos, varnished cambric, felted asbestos, covered with heavy impregnated asbestos braid.

A heavy duty, high-dielectric, heat and moisture resistant flexible cord used in locomotive cab circuits, high wattage lighting units, floodlights and for leads on apparatus exposed to heat. Specify polarized conductors if desired. For high temperature applications where resistance to moisture is not required specify All-Asbestos insulated constructions.

ROCKBESTOS ALL-ASBESTOS 600 VOLT RHEOSTAT CABLE
(National Electrical Code, Type AIA)

Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this cable for wiring rheostats, switchboards, elevator and locomotive control panels and equipment exposed to heat, fumes or fire hazard — also for open power circuits in hot, dry locations. For flexible conductor specify Rockbestos All-Asbestos Flexible Apparatus Cable — for solid conductor, Rockbestos All-Asbestos Rheostat Wire.

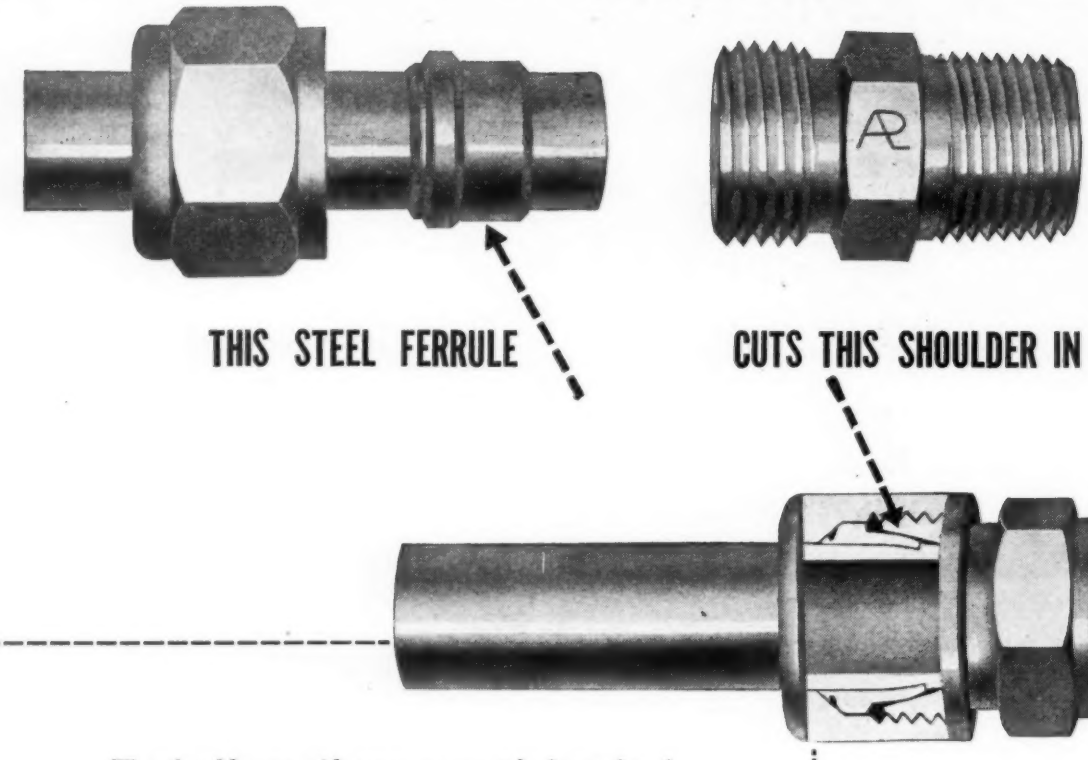
WON'T bake brittle, bloom, burn or rot— RESIST heat, moisture, oil, grease and fumes

ROCKBESTOS PRODUCTS CORP.
602 NICOLL STREET, NEW HAVEN 4, CONN.

ROCKBESTOS

The Wire with Permanent Insulation

ON FERULOK FLARELESS FITTINGS



The shoulder provides a *permanent* leakproof seal —and the ferrule does the complete job; you won't need any special tools.

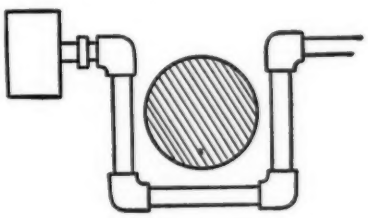
When the nut is first pulled up, this controlled cut on the outside of the tube wall is formed once and for all—regardless of draw marks or surface scratches on the tubing. The ferrule *locks* into position and *stays* there, even through repeated reassembly.

For heavy wall or hard tubing, the new PARKER Ferulok fitting is the last word in an easy-to-assemble, vibration-proof, pressure-tight joint. Write for bulletin A57.

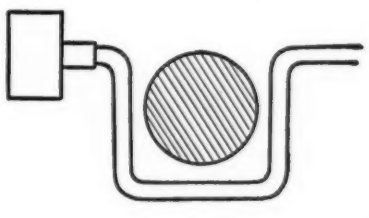
THE PARKER APPLIANCE COMPANY
17325 Euclid Avenue • Cleveland 12, Ohio
Offices: New York, Chicago, Los Angeles, Dallas, Atlanta
Distributors in Principal Cities

Parker
TUBE FITTINGS • VALVES

FREE FLOW— a comparison



OLD METHOD—Each connection threaded—requires numerous fittings—system not flexible or easy to install and service. Connections not smooth inside—pockets obstruct flow.



MODERN METHOD—Bendable tubing needs fewer fittings—no "threading on the job"—system light and compact—easy to install or service—no internal pockets or obstructions to free flow.

IS YOUR SLIPPAGE SHOWING?

..Important question for users of reciprocating pumps and air or hydraulic cylinder mechanisms

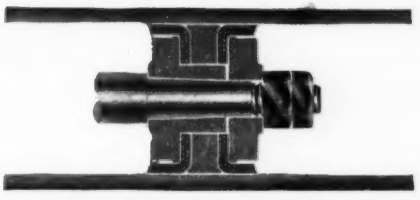
ILLUSTRATIONS at right show how Darcova Pumcups, in contrast to ordinary piston packing, virtually eliminate fluid slippage for the entire life of the packing. And, Pumcup life is many times that of ordinary packing.

By holding slippage to an absolute minimum, Pumcups permit reduced operating speeds, maintain high volumetric efficiency, prolong equipment life, save power, prevent wire-draw and uneven cylinder wear, and eliminate the need for frequent replacement shutdowns.

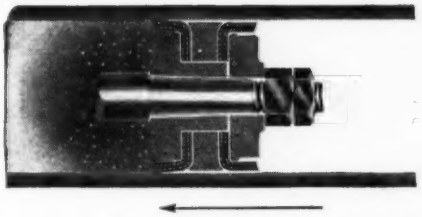
So if slippage is showing up in your operating and maintenance records . . . if replacement of packing is a too-frequent chore, that's your cue to switch to Darcova Pumcups.

For a free bulletin containing complete information, write, or use the coupon below.

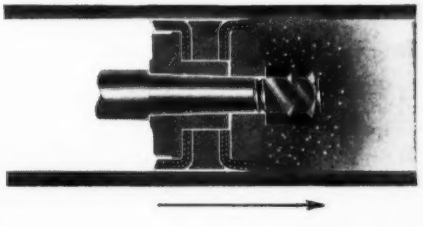
DIAGRAM OF PUMCUP ACTION GREATLY EXAGGERATED



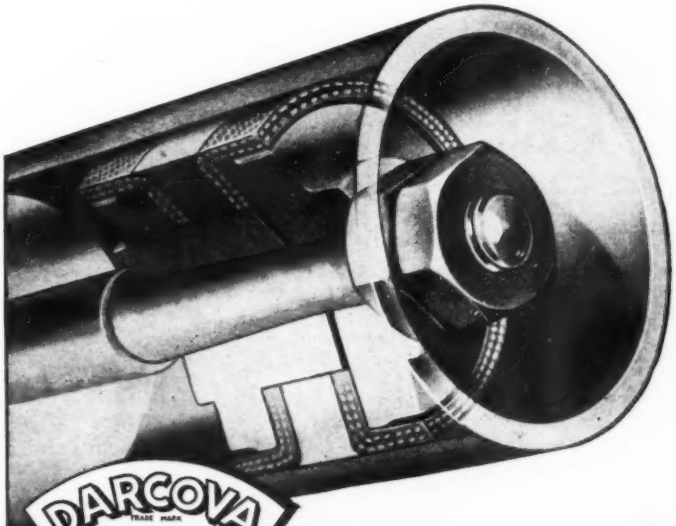
NORMAL: BOTH PUMCUPS RELAXED



UNDER PRESSURE: PUMCUPS SEAL AGAINST CYLINDER DESPITE WEAR, MINIMIZING SLIPPAGE



Darcova Pumcups replace ordinary packing in reciprocating pumps and also in air or hydraulic control mechanisms. They are precision built of an exclusive, exceptionally durable composition material available in many textures for use with almost any fluid under a wide range of pressures and temperatures. Standard sizes range from ½ to 42 inches in diameter.

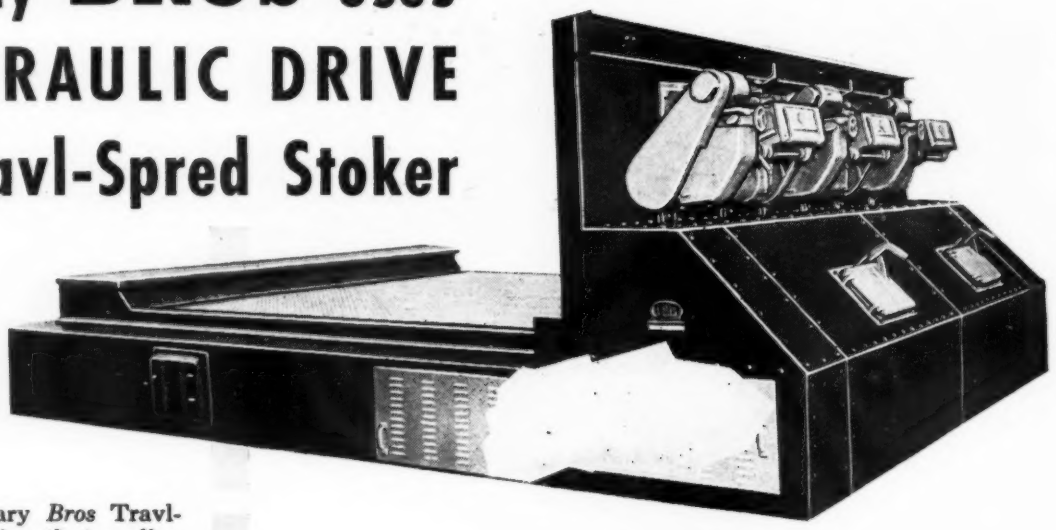


DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

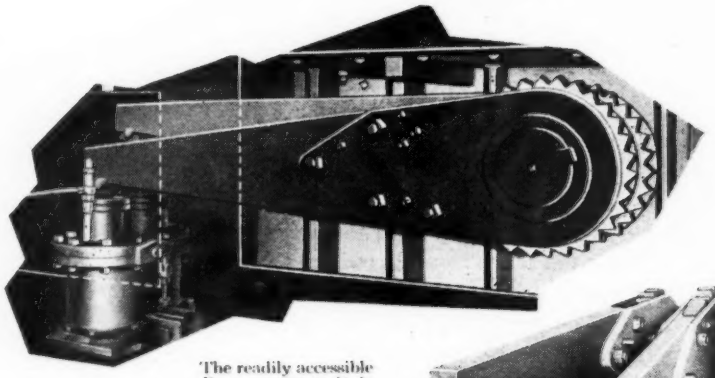
Darling Valve & Mfg. Co., Williamsport 61, Pa.
Please send me the free bulletin checked below:
☐ No. 4401... Darcova Pumcups for reciprocating pumps.
☐ No. 4502... Darcova Pumcups for air or hydraulic mechanisms.

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

Why **BROS** uses HYDRAULIC DRIVE in the Travl-Spred Stoker



• The revolutionary *Bros* Travl-Spred Stoker combines the traveling grate with spreader feed to bring new economy, new efficiency to installations of unlimited horsepower. To keep the grate traveling for continuous ash discharge, *Bros* utilizes hydraulic drive for minimum power costs, and a saving of valuable boiler room space. It's this up-to-the-minute design—combined with zoned burning areas and exclusive tuyere type grates—that makes the *Bros* Travl-Spred Stoker the pace setter in the stoker field.



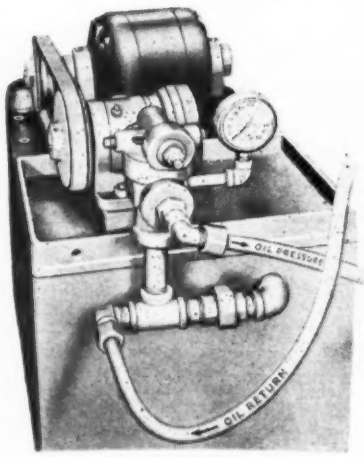
The readily accessible *Bros* power unit is mounted in the stoker housing.

Less Space is required by the compact *Bros* hydraulic drive that operates directly on the main drive shaft of the stoker. Cumbersome gear reductions and variable-speed transmissions, inherent in mechanical drives, are eliminated.

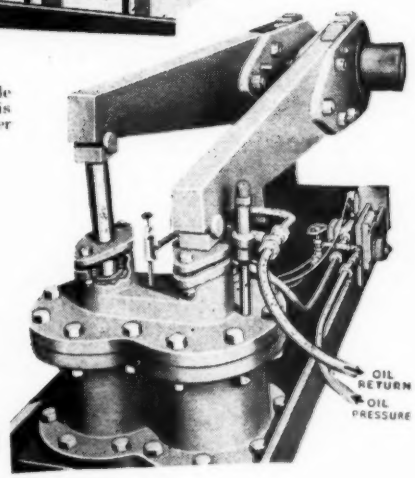
Lower Cost operation is maintained with the streamlined drive that uses only a low horsepower motor for electrical energy.

More Efficiency results from the self-contained oil pumping unit which can be located at any convenient place in the boiler room.

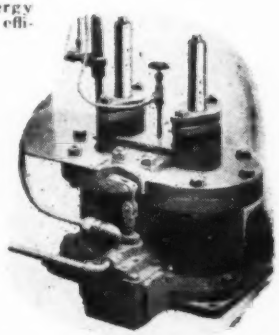
Greater Safety is assured with the relief valve which eliminates safety clutches and shear pins, protects equipment and personnel.



Only electrical unit in entire *Bros* grate mechanism is a low horsepower motor which economically drives pump to energize complete hydraulic drive.



This compact *Bros* hydraulic drive converts hydraulic into mechanical energy with maximum efficiency



The exclusive *Bros* design incorporates duplex cylinders, 4-way valve and pilot valve into one compact unit. Excess piping is eliminated.

BROS

WM. BROS BOILER AND MANUFACTURING COMPANY

MINNEAPOLIS, MINNESOTA

INSTALL STEEL PIPING ADEQUATE FOR TOMORROW'S NEEDS

It took a bond issue to replace piping..... so school children could drink

IN a certain Ohio city, a bond issue was submitted to the voters for modernizing a school building. The most publicized item of the modernization program was a provision to install a complete new system of drinking fountains. In planning and erecting the building several years ago, those responsible had failed to specify and install steel pipe large enough to insure a free flow of water to the fountains on all floors.

How much cheaper for the taxpayers --and how much healthier for the children--if adequately sized pipe had been installed in the first place! Then, it would have cost only a few cents a foot more; now, it's costing thousands of dollars more to get fountains that work satisfactorily.

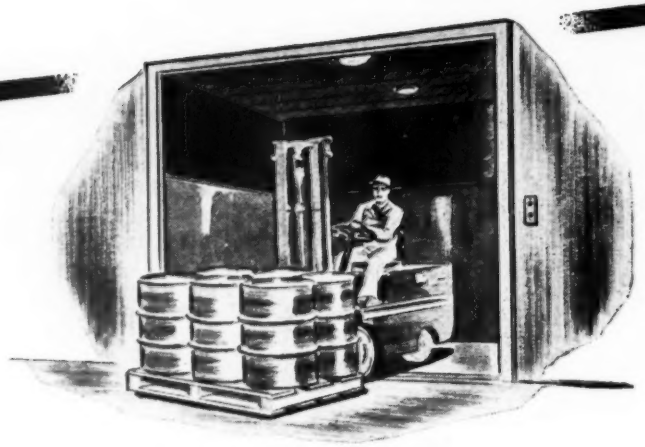
Youngstown pipe distributors are prepared to recommend and furnish steel pipe of proper sizes for any job, adequate for tomorrow's needs.

QUALITY
YOUNGSTOWN
SERVICE
YOUNGSTOWN
YOUNGSTOWN
YOUNGSTOWN
THE YOUNGSTOWN SHEET AND TUBE COMPANY
GENERAL OFFICES . YOUNGSTOWN 1, OHIO
Export Offices - 500 Fifth Avenue, New York City
Manufacturers of
CARBON . ALLOY AND YOLOY STEEL
PIPE AND TUBULAR PRODUCTS . SHEETS . PLATES . CONDUIT . BARS . RODS . WIRE . COLD FINISHED
CARBON AND ALLOY BARS . ELECTROLYTIC TIN PLATE . COKE TIN PLATE . TIE PLATES AND SPIKES

No Stops for Re-handling

with an Otis

POW-R-TRUCK ELEVATOR



Loaded trucks can be driven right onto an Otis Pow-R-Truck Elevator — deliver loads direct to any desired level!

When you install an Otis Pow-R-Truck Elevator, time and manpower savings result—because a Pow-R-Truck Elevator *banishes re-handling of loads* bound for other floors.

Otis Pow-R-Truck Elevators are the world's only standardized line of elevators specifically engineered to carry fast, heavy industrial trucks.

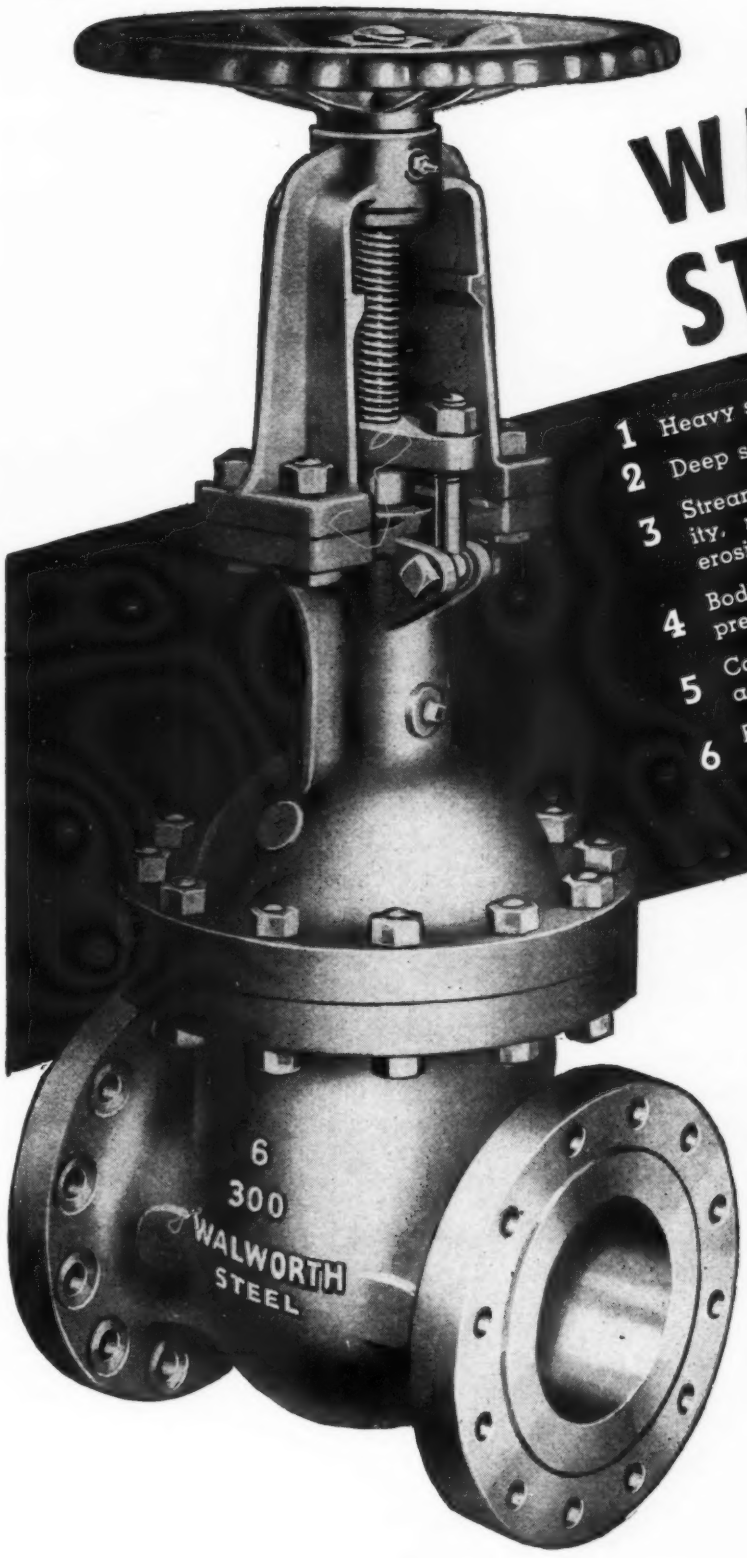
The special features of Otis Pow-R-Truck Elevators include heavier platforms, stronger side braces, extra-rugged carframes and reinforced guide rails and supports. These elevators are available in all sizes, speeds and capacities.

If you want Pow-R-Truck Elevators to eliminate re-handling in *your* plant, write for Bulletin 664 to Otis Elevator Company, 260 Eleventh Ave., New York 1, N. Y.

ELEVATOR COMPANY

Offices in all principal cities

You get all these BIG features in WALWORTH STEEL VALVES



1. Heavy steel walls for extra strength and protection.
2. Deep stuffing boxes to eliminate costly leaks.
3. Streamlined ports to make possible a high velocity, non-turbulent flow, and reduces possible erosion.
4. Bodies and bonnets engineered to withstand pressure and minimize distortion.
5. Cast body guide rib faces, machined to insure accurate disc centering.
6. Exact design, metallurgy and construction of yoke nuts, bonnet bushings, gland followers, handwheels and other vital parts to assure better service for a longer period of time.

Is there any wonder that out in the field, where approval is based on performance under actual operating conditions, industry has put its O.K. on Walworth Steel Valves?

Tough . . . wear resistant . . . dependable, these valves are produced in gate and globe types, in sizes to cover practically every service requirement. They are excellent examples of Walworth leadership . . . leadership that has made the Walworth valves famous throughout the world.

Walworth Catalog 42 gives complete information regarding Steel Valves as well as the full line of Walworth valves and fittings in bronze and iron. Your copy may be obtained upon request. Whenever you need valves — whether steel, bronze or iron — remember Walworth for dependability, economy, and long service life.

WALWORTH
valves and fittings
60 EAST 42nd ST., NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Practical

FOR HIGHER TEMPERATURES

NORTON REFRACTORIES are practical for higher temperatures because they are **special refractories,** and that's what special refractories are made for: *heavy duty work at high temperatures.*

The five qualities of special refractories as manufactured by Norton Company are:

1. high refractoriness at elevated temperatures,
2. great physical strength — even at high heat,
3. chemical stability giving resistance to slag,
4. excellent heat transfer properties,
5. resistance to abrasion and to slag penetration.

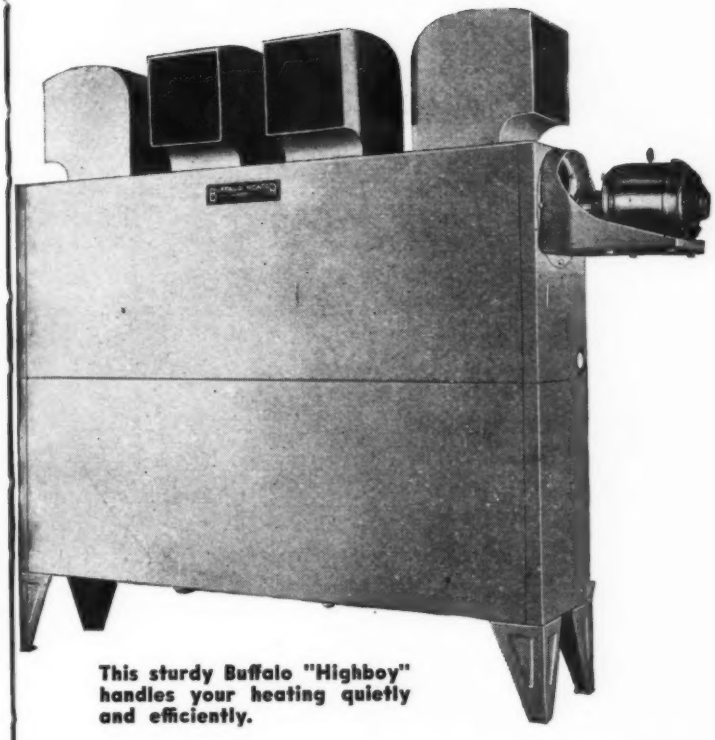
If the refractories you are using now are not suited to long service at the temperatures at which your plant is operating, or if higher operating temperatures are desired, then investigate the benefits to be gained from using special refractories by writing to:

Refractories Division, Norton Company
Worcester 6, Massachusetts

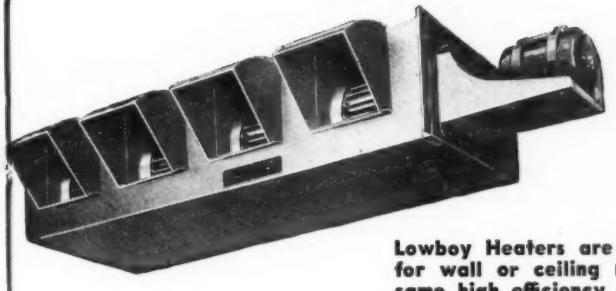
NORTON COMPANY, WORCESTER 6, MASS.

HEAVY DUTY UNIT HEATERS

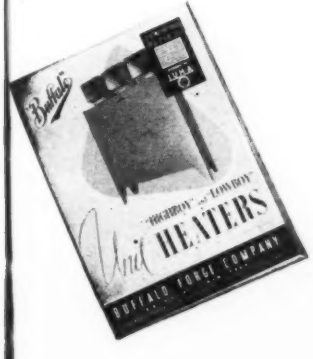
Save Money FOR LARGE AREA HEATING



This sturdy Buffalo "Highboy" handles your heating quietly and efficiently.



Lowboy Heaters are suitable for wall or ceiling mounting same high efficiency as Highboys.



Write today for Bulletin 3134A on Highboys and Lowboys, *and Bulletin 3137-C* on Breezo-fin Heaters, if you have a heating problem coming up.

NOT NEW!

The Buffalo Unit Heaters shown here are alll pre-war models. They were designed in the beginning for industrial service, and so far, we haven't seen anything better for that service. Highboys, Lowboys and Breezo-fins—all are in use all over the country—giving efficient economical heating in factories, warehouses, stores and offices.

NOT RADICAL!

About the design of these units—there's nothing that can be considered a radical innovation. We just draw the air over some copper finned steam coils, good for pressure up to 200 lbs., and deliver it, by means of quiet Buffalo fans, right where you need it. Because the fans and coils are efficient, you get economical heating.

NOT UNIQUE!

There are no "super-gadgets" on Buffalo Unit Heaters. The casings are heavy enough to withstand the handling and usage they can expect, without denting. Ball bearings are amply large, as are fan shafts. Fan rotors are dynamically balanced for continuous quiet operation.

PRACTICAL!

Buffalo Highboy and Lowboy Heaters are made in a complete range of practical sizes, to fit industrial requirements. They may be used as floor-type units, mounted upright on walls or girders, flat suspended under the roof, or suspended inverted. Because the fans will deliver air against duct-resistance, one unit can be used to heat several rooms. Full automatic controls are available for all models.

TIME TESTED!

Some of the largest industrial plants in the world are heated with Buffalo Unit Heaters. Because we build all our equipment for "extra-duty" service, you'll find that units ten, fifteen, even twenty years old are still on the job.

BUFFALO FORGE COMPANY

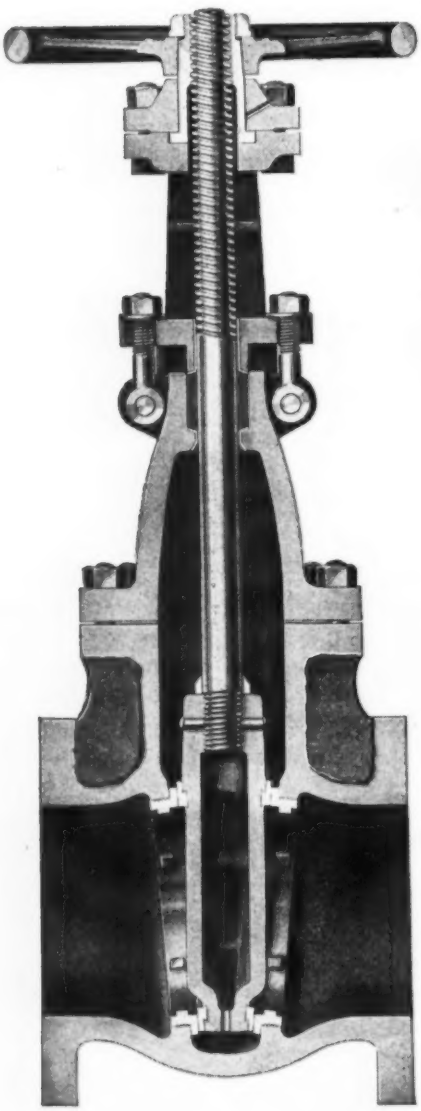
488 Broadway Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

HIGHBOY & LOWBOY UNIT HEATERS

All Four Favor Kennedy



Chief Engineer

"With Kennedy Valves controlling the pipe lines, I know that I won't get any complaints about excessive pressure losses, service interruptions or maintenance expenses due to valves, and no kicks from the men about operating difficulties or frequent time lost due to valve maintenance."

Operating Engineer

"I like Kennedy Valves because they open easily and close tight — and I mean tight. Then, there's never any trouble to connect them on the line, because the screwed ends are accurately threaded and the flanged ends are always true."

Maintenance Man

"You ought to see how quickly I can re-pack a Kennedy Valve, thanks to the many Kennedy stuffing box conveniences. Besides I know I'm safe from emergency calls to fix a Kennedy Valve."

Purchasing Agent

"The Kennedy line helps plant standardization, because I can always find just the right Kennedy type for all our regular requirements in bronze and iron body valves. Their catalog is a honey for completeness and convenience, too."

The large Kennedy line includes gate, globe, angle and check valves, in bronze and iron body, for low, standard, medium and extra-heavy pressures . . . also a complete range of standard bronze and malleable iron screwed fittings, standard cast iron flanged fittings, and standard and extra-heavy cast iron companion flanges . . . all fully described in Catalog 63. Write for your copy today. • *BUY FROM YOUR LOCAL DISTRIBUTOR*

THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK

Offices and Warehouses in Principal Cities

KENNEDY

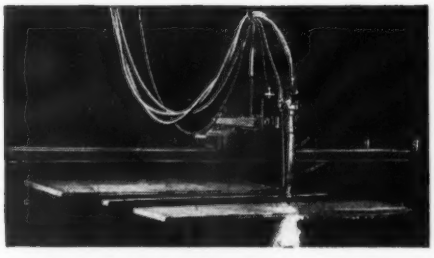
valves–pipe fittings–fire hydrants

"Tailored steel" becomes a regular steel warehouse commodity when an OXWELD shape-cutting machine is used.

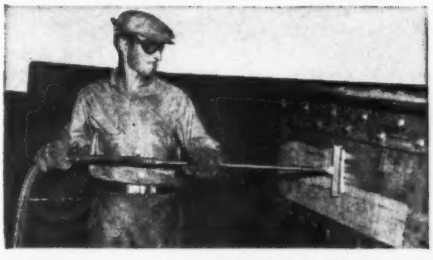
LINDE process service cuts production corners

You may be taking advantage of all of the more apparent economies of LINDE methods. Yet, through the broad and comprehensive experience of the LINDE service organization, important additional savings may be made.

LINDE Process Service is available to all LINDE customers through any LINDE office.

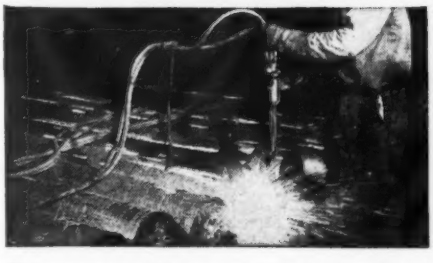


Stainless steel plate, difficult to oxygen-cut by usual methods, can be quickly cut to size and shape by powder-cutting.



Scrubbing steel with a brush of flame removes scale, rust, and surface moisture prior to painting. This is flame-priming, a LINDE development.

HELIARC welding makes strong, clean welds in stainless steel tubing because the weld zone is protected from oxidation by a protecting envelope of argon or helium gas.



The design of a simple jig for centering cold rounds—or the design of a completely mechanized flame-conditioning installation — are examples of LINDE Process Service.

Linde

The words "Linde", "Oxweld" and "Heliarc" are registered trade-marks of Units of Union Carbide and Carbon Corporation.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd St., New York, 17, N.Y. UCC Offices in Other Principal Cities

In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

A Climax to Years of Development

BALDWIN

SERIES 600

Diesel Engines

5-6-7 or 8 cylinders

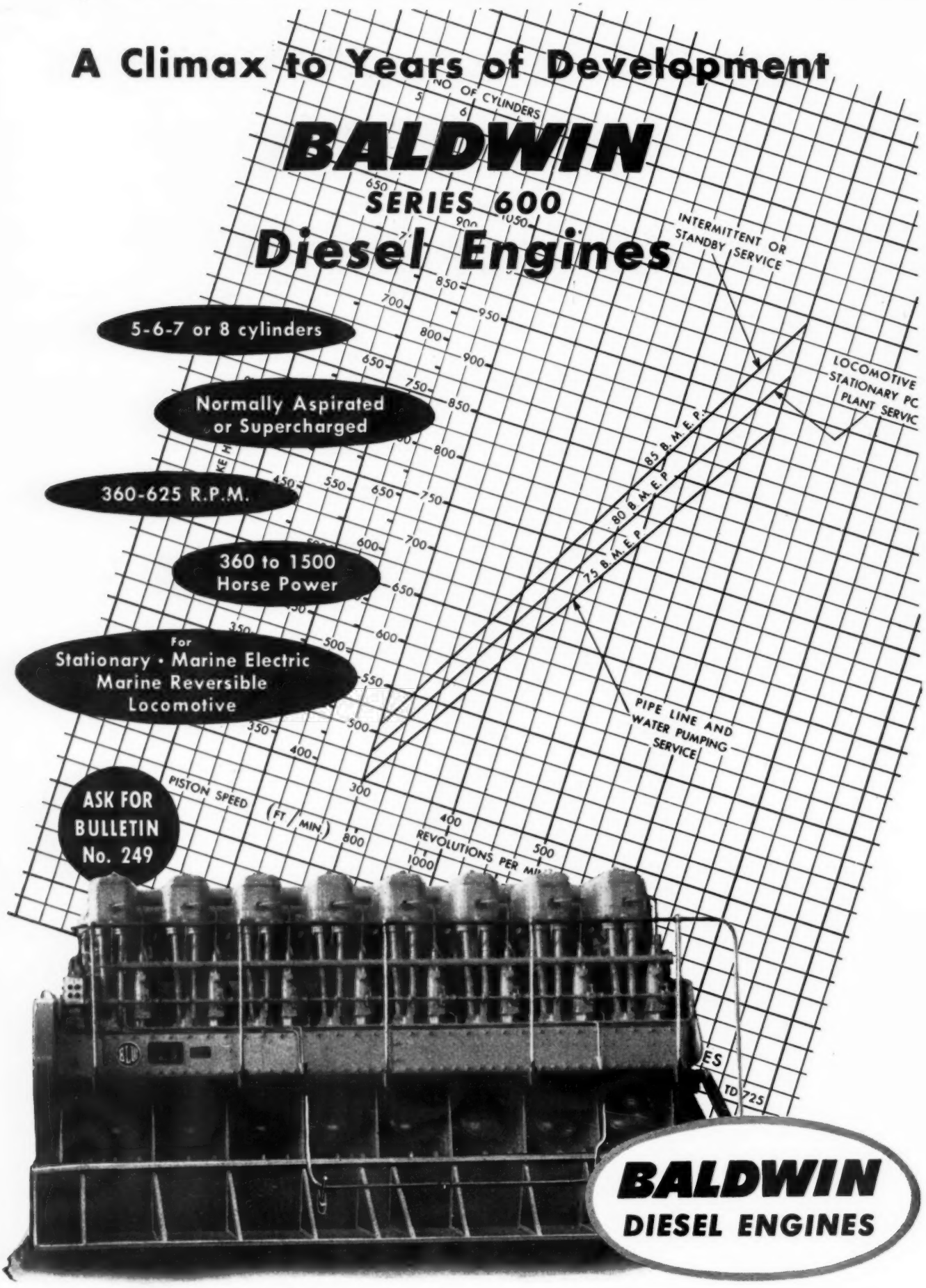
Normally Aspirated or Supercharged

360-625 R.P.M.

360 to 1500 Horse Power

For Stationary • Marine Electric Marine Reversible Locomotive

ASK FOR BULLETIN No. 249

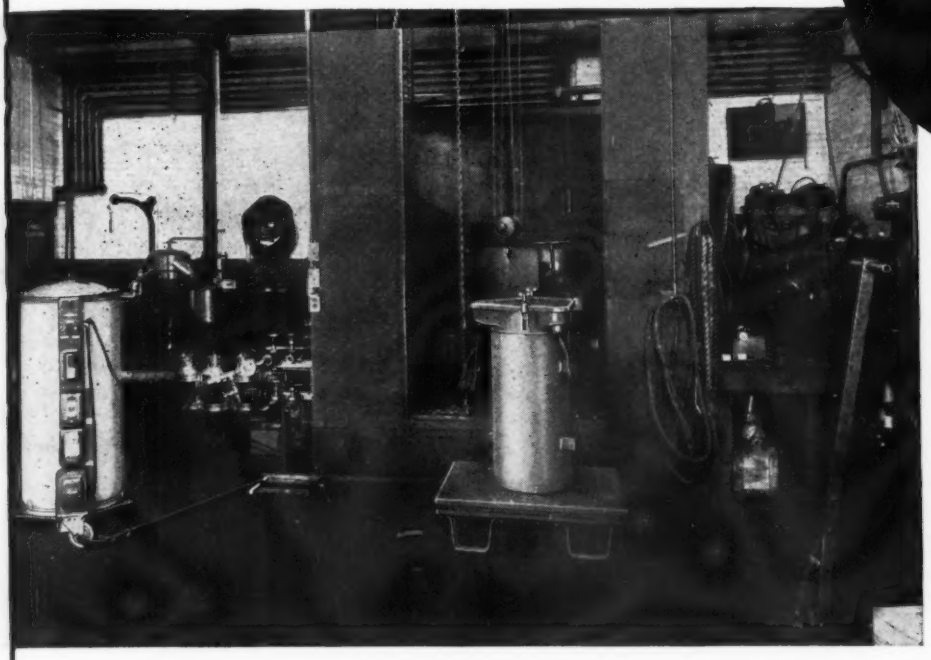


BALDWIN DIESEL ENGINES

THE BALDWIN LOCOMOTIVE WORKS—*Paschall Post Office, Philadelphia 42, Pa.*

Neither scientific research nor industrial practice has found a better way to recondition insulating oils

HONAN-CRANE PURIFIERS for insulating oils

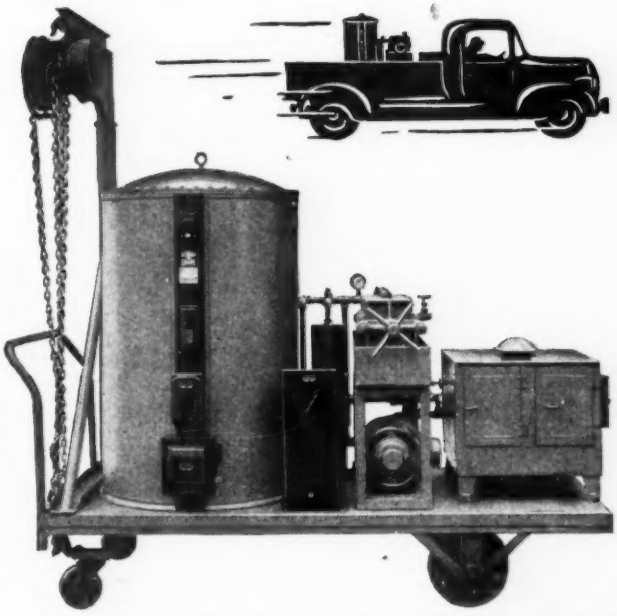


The Hartford (Conn.) Electric Company uses a No. 2030 HONAN-CRANE OIL PURIFIER to remove oil-soluble sludges, minute particles, acids and other objectionable contaminants which remain in insulating oil after centrifuge and blotter-press treatment. Contaminated oil from main and distribution transformers and oil circuit-breakers is brought to the plant for servicing by this central purification system. No insulating oil has been discarded since the Honan-Crane installation was made. Before H-C was installed, contaminated oil was used only for boiler "light-off" and road maintenance. Records show the reconditioned oil to be completely satisfactory for continued use.

H-C PURIFIERS Not Only RESTORE the Oil to Original Condition—but IMPROVE Its Resistance to Oxidation and Sludge-Forming Tendencies.

Many power plants prefer a preventive-maintenance-in-service program which utilizes the complete, portable *Honan-Crane Type "R" Purifier* illustrated at right—thus eliminating tanks by providing "on the spot," regularly scheduled oil reconditioning at any desired place in the plant—or in the field. The Type "R" Purifier is self-contained, including blotter-press and Fuller's earth filter, complete with pump, motor, drying oven, flexible hose and hoist, all mounted on a convenient four-wheeled truck. The entire unit loads easily on a small motor-truck for operation in the field. It makes possible a complete oil reconditioning program without interference in the normal operation of the electrical equipment.

All Honan-Crane Transformer and Insulating Oil Purifiers employ Cranite (a special grade of Fuller's earth which is the finest and most effective oil purification medium known). Used in combination with a blotter-press for removal of water, Honan-Crane Purifiers have proved themselves to be unmatched in performance by any process. They will not only restore the oil to its original condition, but likewise will improve the resistance of the oil to oxidation and sludge-forming tendencies. In as much as transformer and insulating oils are of low viscosity, the purification cost is negligible.



FOR COMPLETE INFORMATION, PLEASE FILL OUT AND MAIL THE COUPON ON THIS PAGE.

HONAN-CRANE CORPORATION

1200 SIXTH STREET, LEBANON, INDIANA

A SUBSIDIARY OF *Houdaille-Hershey* CORPORATION

☐ Please have a sales-engineer call.

☐ Please send me engineering bulletins on purification of insulating oils, and full information on **Honan-Crane Oil Purifiers.**

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COMPANY.....

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CITY..... STATE.....

HAHN PRODUCTS FOR ECONOMY & EFFICIENCY

PIPE-LINE or PNEUMATIC CONVEYORS
FOR ASHES AND FLY-ASH

"Most economical in steam-consumption and maintenance." Design of every part, fitting, etc., based on our experience of 25 years with the successful manufacture and operation of conveyors of this type and on our full appreciation of their special requirements.

We also specialize in improving existing conveyors through our superior fittings and frequently through rearrangement of present layouts.

CAST IRON SECTIONAL ASH TANKS, COAL BUNKERS, BINS, HOPPERS and SILOS

Durability combined with our exclusive discharge- and self-clearing designs, preventing arching, packing and spontaneous combustion in case of coal bunkers and also obviating the necessity of hazardous trimming.

MECHANICAL SOOT BLOWERS FOR FIRE-TUBE BOILERS of ALL TYPES

Fixed nozzle centered to each tube. No cutting of tube - sheet. No moving parts in hot boiler. All tubes in boiler blown with four successive puffs of steam or air in about one minute. Perfect soot-removal from each tube END TO END.

Complete Data on Request

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(formerly Hahn Engineering Company)
:0 Church St. New York 7, N. Y.

Hi-Pressure Gage Glasses

Round, Tubular and Flat Type

RUBBER GAGE GLASS GASKETS
Series 750 . . . All Sizes

Fig. 21 Fig. 22

Other Ernst Specialties

GAGE GLASS ILLUMINATORS
NEW PLASTIC GUARDS
SIGHT FLOW INDICATORS
SPLIT-GLAND WATER GAGE
STEEL GAGE VALVES
FLAT GLASS INSERTS
ALL IRON GAGES
HIGH & LOW ALARM COLUMNS
MICA SHIELDS AND GASKETS
AND OTHER HELPFUL TIPS ON BOILER ROOM SAFETY

Fig. 12

Inclined for Better Visibility
Standard Type—Offset Adjustable Inclined Gage Fittings

Fig. 49

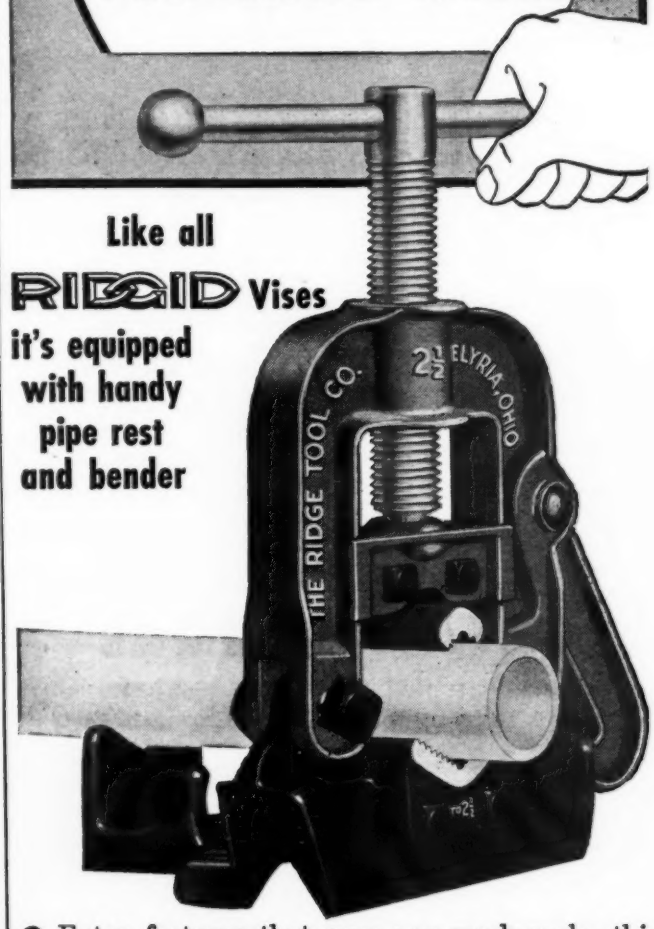
Fig. 13

Leakless Super Try Cocks, Bronze and Forged Steel Construction

Send for Catalog 48P

Ernst WATER COLUMN & GAGE CO.
LIVINGSTON, N. J. LIVINGSTON 6-1400

THE BENCH *Pipe Vise* FOR EASIER WORK



Like all RIDGID Vises it's equipped with handy pipe rest and bender

● Extra features that save you work make this RIDGID bench yoke vise more for your money. An integral pipe rest, a bender that won't flatten pipe, LonGrip jaws that protect polished pipe. Years of trouble-free service—special malleable frame and heat-treated tool-steel jaws for maximum wear. Eight sizes for pipe to 6 inches—look for the RIDGID red-top at your Supply House.

RIDGID *chain type vises in 5 sizes to 8."*

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE, and COPPER*

Extending Condenser Tube Life by Improving Water Conditions

It is generally recognized that the nature of cooling water has an important bearing upon the life of condenser tubing. If all the factors concerning unsatisfactory water conditions are carefully studied it may be possible to take constructive action which will result in improved water conditions and extended condenser tube life.

For example, a large Eastern power plant located on an estuary at the mouth of a river was experiencing serious condenser tube failures. Investigation by Bridgeport's Corrosion Research Laboratory resulted in several interesting disclosures.

Removing Accumulated Organic Matter

Over a period of many years a layer of organic material had gradually built up on the bottom of the river to a depth of more than ten feet. Decomposition of that material due to bacterial activity, caused the formation of hydrogen sulphide, methane and other gases. This contributed to premature failure of the condenser tubing by destroying the protective film. An additional factor was the silt drawn into the condenser tubing.

Dredging was suggested, and when completed, a marked change was noted in the character of the water. Also, not nearly so much silt and other foreign matter was drawn into the condenser tubing. Various methods for keeping the tubes clean were also used, since slime can reduce condenser vacuum as well as contribute to premature tubing failure.

Since it was also found that vibration was contributing to the failure of tubes in certain parts of the condenser, additional tube support plates were installed. A very marked increase in condenser tube life has already been recorded at this plant.

Reduce Pollution Through Intake Location

Location of the water intake in power plants on land and aboard ship is closely connected with water conditions affecting condenser tube life.

This is recognized in the case of ships which have a high-water and low-water intake. In shallow water, where sand or silt may be stirred up and drawn into the condenser, the high intake is used. However, in rough water where there is a possibility of the high intake sucking in air with the water, causing impingement corrosion, the low intake is used.

Where excessively aerated water is drawn in, devices are sometimes used which eliminate much of the entrained air. If this is not practical, impingement-corrosion-resisting alloys such as Duronze IV* (aluminum bronze), Cuzinal (aluminum brass), and 70-30 cupro nickel should be used.

In stationary power plants there are cases where intakes have been placed too near pipes discharging waste matter containing chemicals, paper pulp, cinders and other contaminators. These contribute toward rapid failure of condenser tubing.

A power plant located on a river was experiencing premature failure of condenser tubing because of pollution from a neighboring paper mill. Since it was not practical to change the character of the river water, a more corrosion-resistant alloy was indicated. Extensive field tests have revealed that Duronze IV is well suited to resist corrosion from this type of pollution.

Preventing Entrance of Foreign Matter

Barnacles, oysters, mussels, and debris can be very troublesome if allowed to pass into the condenser. Such obstructions not only block the tubes, but may also cause impingement attack by deflecting streams of water against the tube wall. If fine screens are used and the intake tunnel is kept clean, much difficulty can be avoided.

Long intake tunnels or channels allow much of the foreign matter to settle out before reaching the condenser. Where more than one condenser is supplied by the same tunnel, the condenser farthest from the entrance collects the least debris and has a longer tube life in general.

Baffles in intake channels have been effective in preventing foreign matter from entering the condensers. However, this necessitates frequent removal of debris from the baffles, which may be the reason why they are not more widely used. Nevertheless such procedure would greatly increase condenser tube life as well as heat transfer efficiency.

Modern Corrosion Resisting Alloys for Longer Service

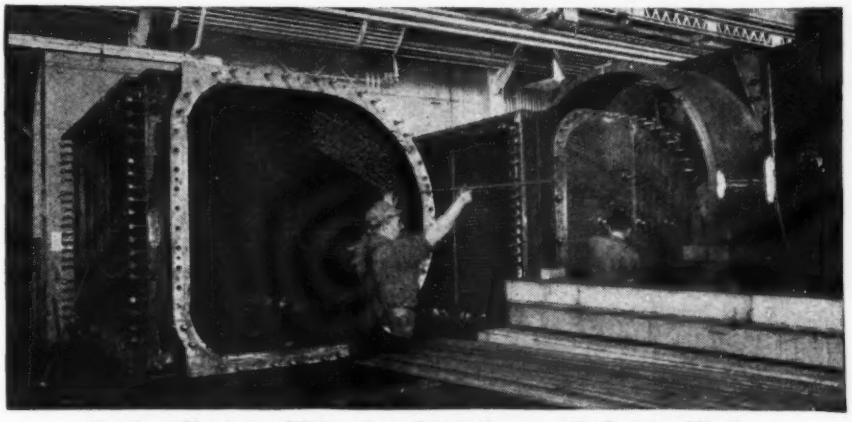
According to a well-known power publication, power producers must increase capacity at a rate of 3.5 to 4.0 million kw. each year for the next five years in order to meet post-war loads and restore normal margins of reserve.

Far sighted operators anticipate the need for additional capacity. They are gaining valuable information about the suitability of condenser tube alloys, through field tests conducted where expansion or new construction is planned. It is also evident that more severe conditions are anticipated since a large percentage of Duronze IV (aluminum bronze) and Cuzinal (aluminum brass) is being specified for future installations.

In cases of new construction, the usual procedure of ordering other equipment ahead of condenser tubing should be reconsidered. In view of the great demand for tubing and its importance in the operation of every power plant, it should be ordered sufficiently far in advance to prevent the possibility of holding up an entire project through lack of condenser tubing.

Condenser Tube Manual

Write for your copy of Bridgeport's 112-page Condenser Tube Manual. It contains valuable information about corrosion research, condenser tube alloys, methods of installing, and suggestions for increasing tube life. *U. S. Patent No. 2,093,380



Inserting tubing in two 7500 sq. ft. surface condensers — Allis-Chalmers Mfg. Co.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal

● You pay a share of this tremendous loss, if you fail to protect iron and steel surfaces from the metal-consuming "fire" of rust. Yet, rust CAN be *stopped* by sealing the surface so that no oxygen can reach and oxidize it. RUST-OLEUM combats rust as effectively as water quenches fire.

For less than 1-cent per square foot you can add years of life to metal roofs, gutters, smokestacks, fire escapes, railings and fences. RUST-OLEUM will positively stop and prevent rust on all types of metal surfaces.

See your distributor or write for Catalog No. 246.

EASY TO USE . . . LASTING PROTECTION

- No expensive preparation. Merely wire brush to remove scale, dirt, etc.
- RUST-OLEUM penetrates remaining rust and incorporates it within the protective film.
- RUST-OLEUM does not crack, blister or peel.
- Excellent coverage . . . Lasts longer.
- Full selection of colors.

APPLY BY BRUSH, DIP OR SPRAY

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2447 Oakton Street
EVANSTON, ILLINOIS

FOR FAST • SAFE • EASY GASKET REPLACEMENT

The only tool that takes the guesswork out of replacing gaskets, regardless of location. Flanges are parted quickly and held in perfect alignment without damage to faces . . . shock and jarring of pipe lines are eliminated . . . there is no danger from flying wedges . . . no sparks caused by hammer blows. FLANGE-JACKS eliminate costly shutdowns, make possible fast, economical repairs in hard-to-get-at locations, offer maximum safety.

J. H. WILLIAMS & CO.
Buffalo 7, N. Y.

Standard No. 20 $24.00 a pair
Giant No. 30 $48.00 a pair
See your distributor for trade discounts

SOLD IN PAIRS

WILLIAMS Flange-Jacks

All features you desire

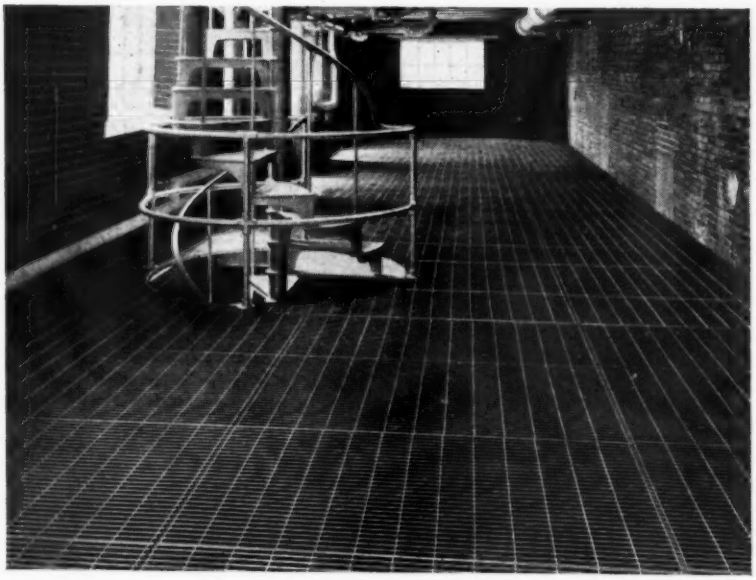
in

OPEN STEEL FLOORING

are assured when you specify Mitco. Note these outstanding advantages—

- 90% open area for light and ventilation.
- Square-edge, uniformly spaced metal bars provide non-slipping, level walking surface.
- Pressure-formed integral construction obviates weaknesses of bolts, rivets and angle irons—eliminates dirt-catching and light-obstructing projections.
- Heavy loads are supported without lateral deflection of flooring, because every Mitco panel is strong, integral unit.

Write for full information.



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Manufacturing Company
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Sales Offices In Principal Cities

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring, "Shur-Site" Treads and Armorgrids

Making molehills out of mountains

Ever stop to think that the bulk materials you have to handle, if piled together—miraculously enough—would make a small mountain?

Whether it's a mountain of stone, sand, coal, coke, gravel, copper ore, or excavated material, you want to move it at the lowest cost per ton!

The easy, quick, efficient way to move that kind of mountain is to install Robins Conveyors. They make molehills out of mountains . . . move them at speeds up to 2000 tons per hour.

Whether you're digging for diamonds, loading a coal boat or building a dam, you'll like the way Robins Conveyors cut operating costs. And you'll like their rugged construction, their simplicity of design.

What's more, Robins is the only organization that offers a complete conveyor system . . . including world-famous Hewitt belting. No need to "piece together" your conveyor system from several different sources! Robins engineers the entire job for you.

Write now for complete information on how Robins can help you. There is a Robins Conveyor to meet your individual need.

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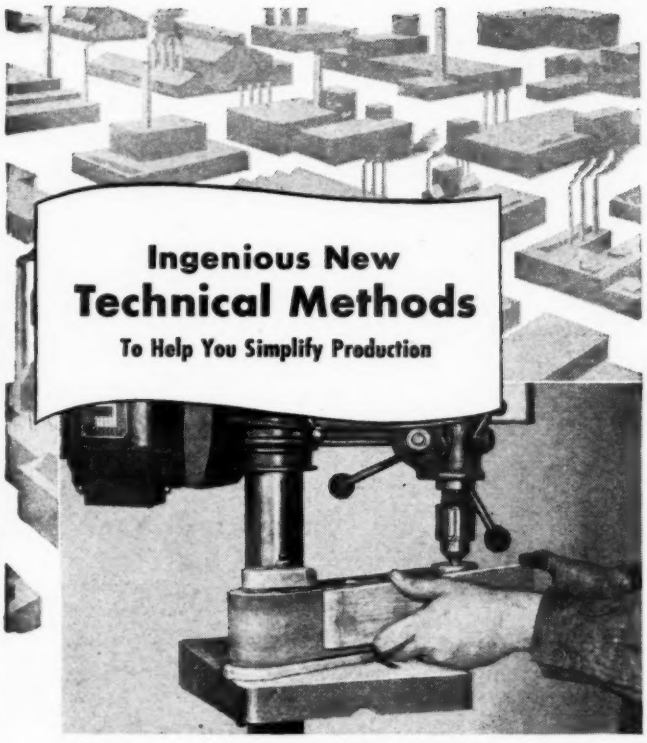
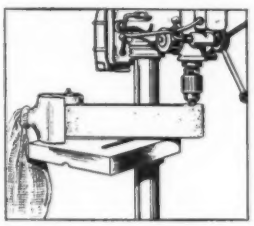


Ingenious New Technical Methods

To Help You Simplify Production

NEW BELT SANDER FOR DRILL PRESS
Does Finishing Jobs Faster, Better

A new, simple, faster method for many surface finishing jobs on wood, metal, plastic and other materials has been announced by the OK Specialty Company of Chicago. The new finishing method takes the form of the OK Belt Sander, a drill press attachment.



OK Belt Sander
Assembled, Ready for Action

The new sanding device weighs less than 5 pounds. It is made up of an aluminum base with backing plate or platen, a driven pulley mounted on ground steel shaft and running on precision ground ball bearings, and cast aluminum driver pulley mounted on ½" ground steel shaft to fit into the drill press chuck.

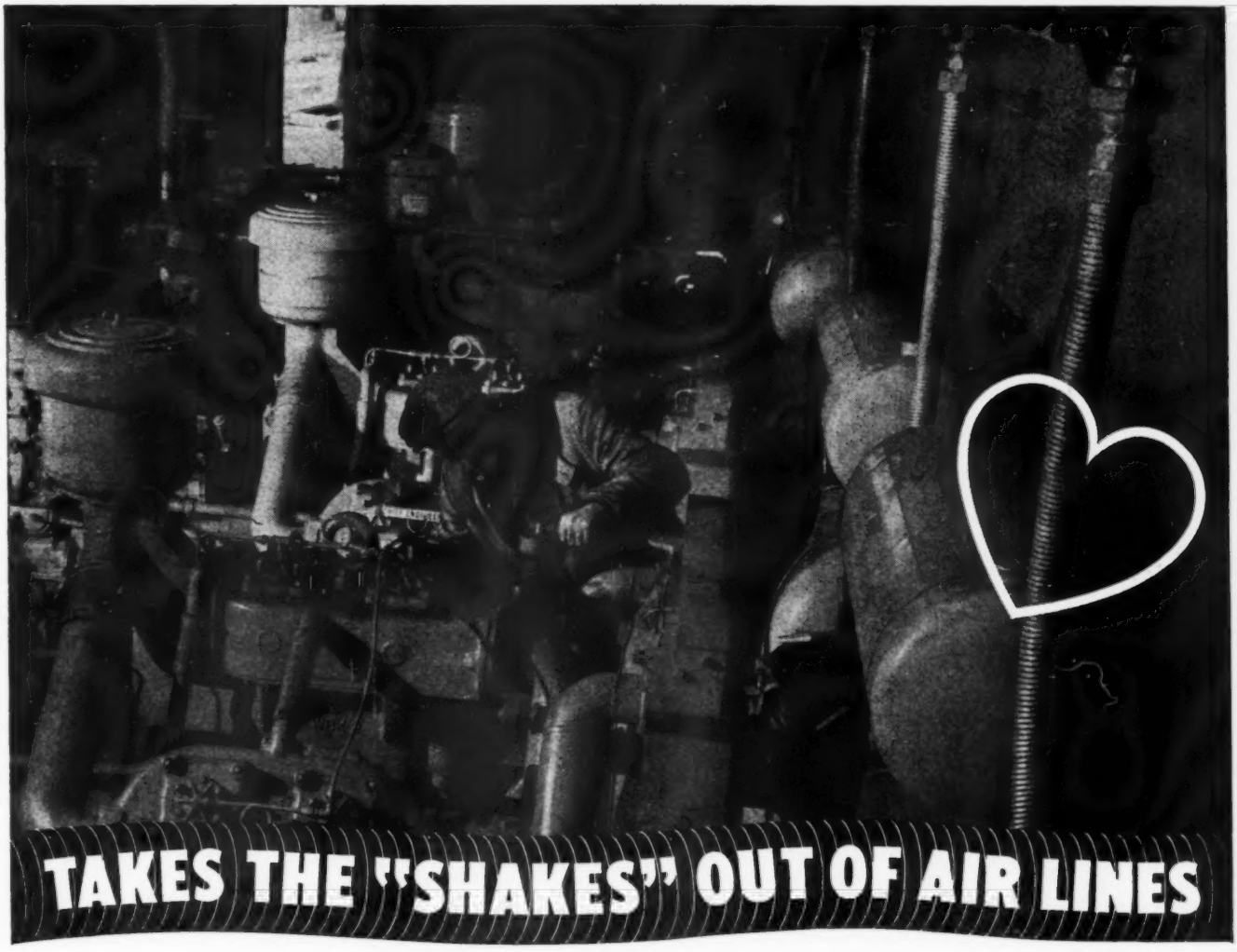
The base of the sander is bolted to a drill press table. Merely by moving the drill press table, the attachment can be adjusted to handle sanding belts from 26" to 36" in length.

The sander takes belts from ½" to 3" in width. Two sanding belts, one coarse grit and one fine grit, are furnished with each attachment. The device comes assembled ready for use with any drill press. Most efficient performance is achieved at 3500 to 5000 RPM. The sander stands 5" high, and the base measures 10½" long by 3¼" wide.

Another time-saver on the job is chewing gum. Chewing gum may be used even when hands are busy; and under dust conditions helps to keep the throat moist—prevents "false thirst." For these reasons many plant owners make Wrigley's Spearmint Gum available to everyone.

You can get complete information from
OK Specialty Company,
4655 N. Clark St., Chicago, Ill.

AB-70



TAKES THE "SHAKES" OUT OF AIR LINES

Penflex Flexible Metallic Hose prevents vibrations on compressed air lines, easily... safely... economically

With a mighty roar, 15 diesel-powered air compressors pump a steady air supply for air tools and equipment used on a world-known project. During the installation of these powerful compressor units, a method was required to prevent constant vibration from being transmitted to the rigid air lines.

That's where Penflex "Flexineering" service paid off. By using 3" Penflex interlocked flexible metal hose as connectors between compressors and pipe lines, the "shakes" are eliminated. Tight as a pipe, but flexible, Penflex hose "soaks up" constant vibration, assuring smooth air power . . . leak-proof, low-cost service. Penflex hose is also used to carry off obnoxious diesel exhaust, preventing dangerous leaks and vibration.

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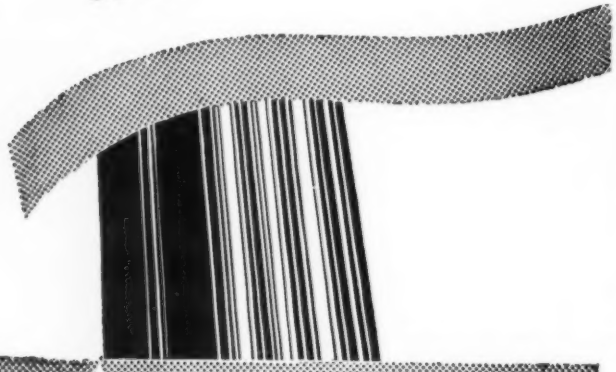

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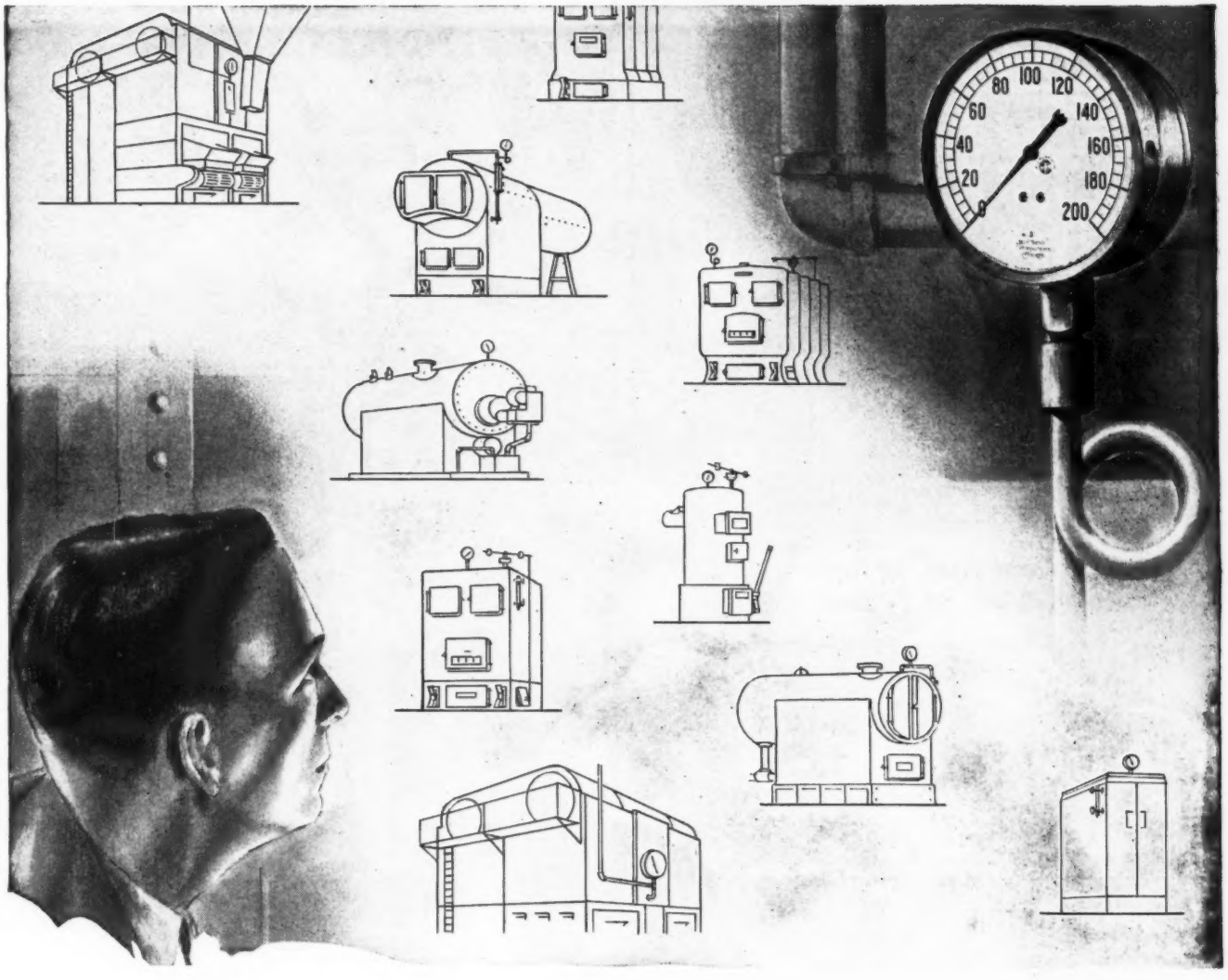

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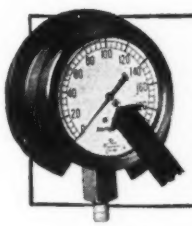

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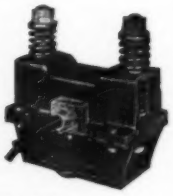

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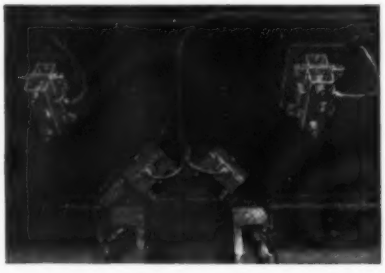

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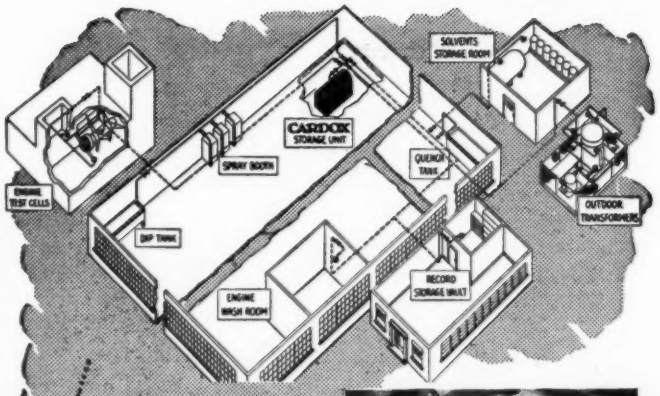

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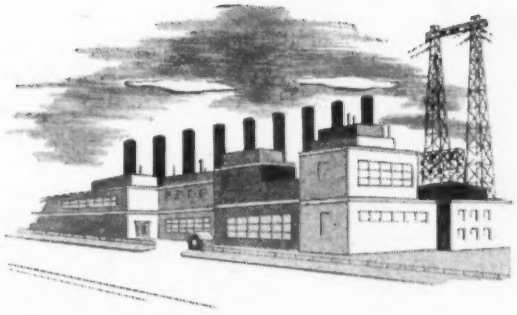

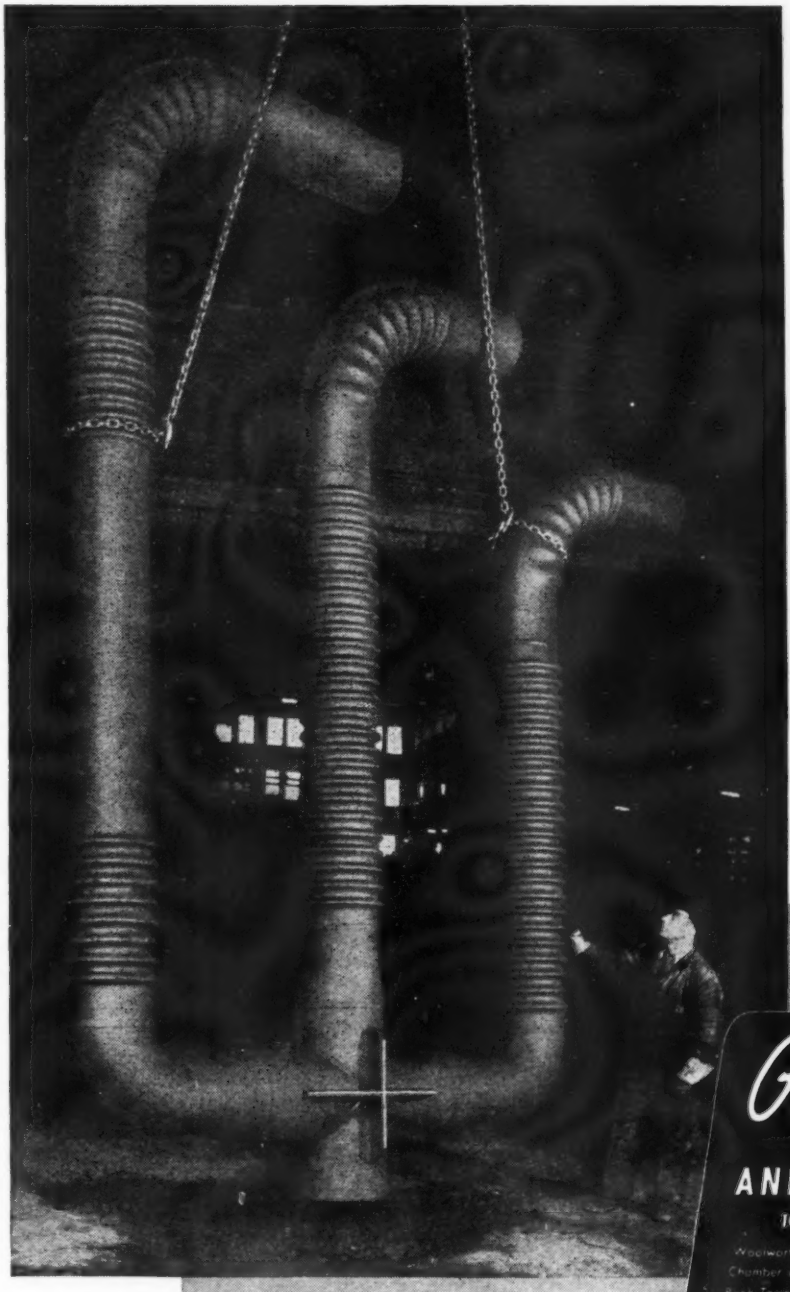

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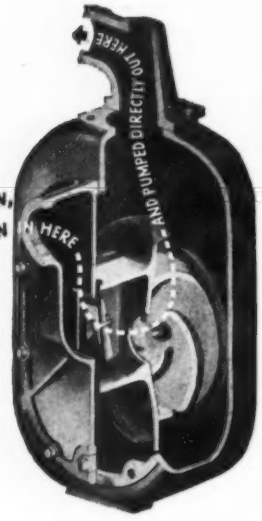

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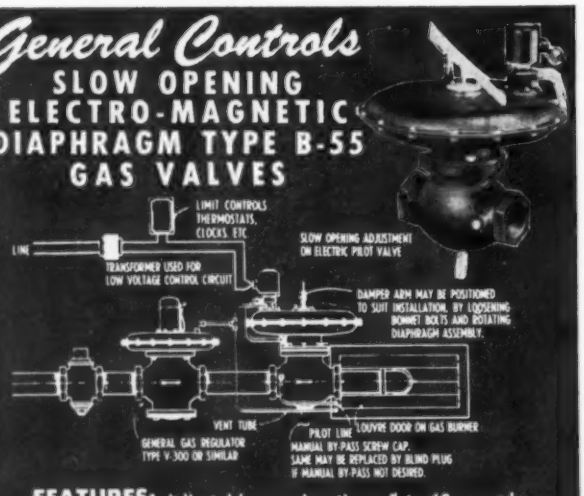
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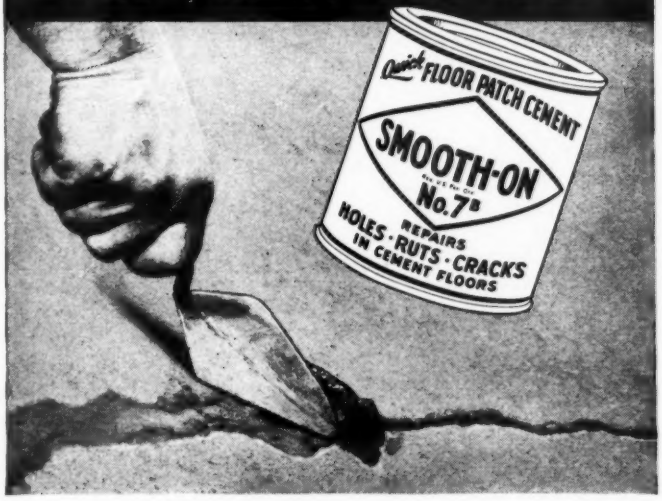

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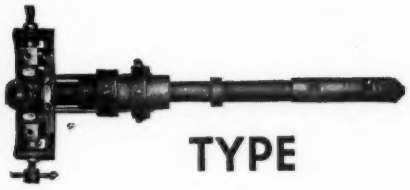

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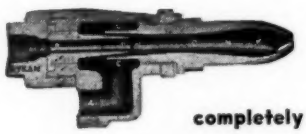

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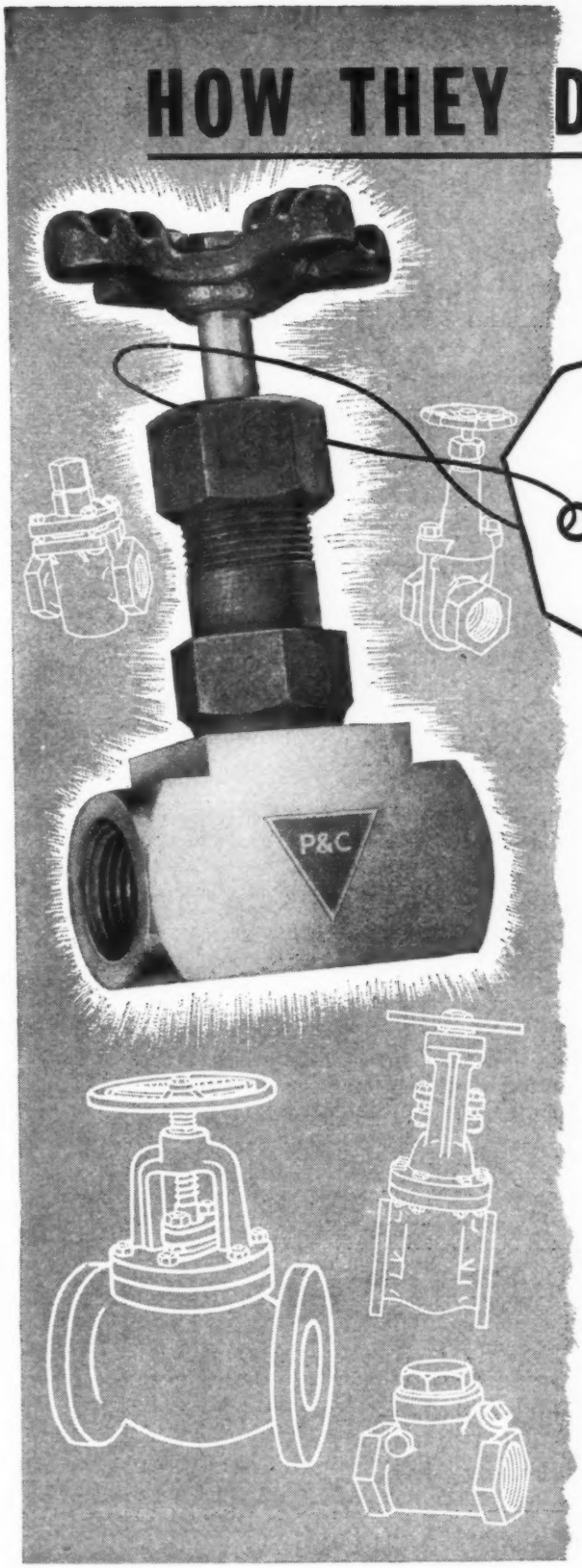

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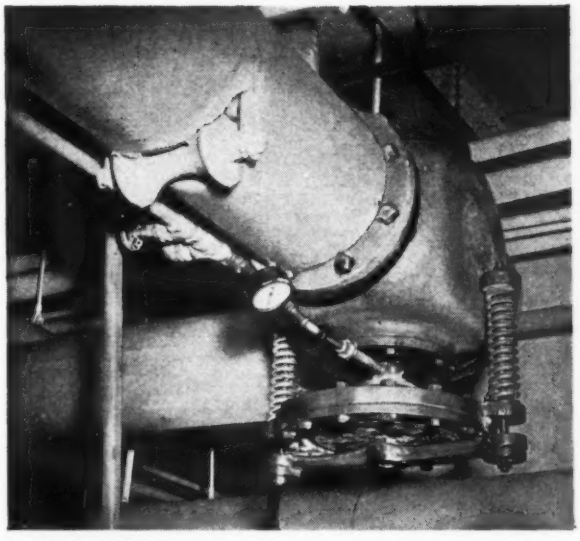

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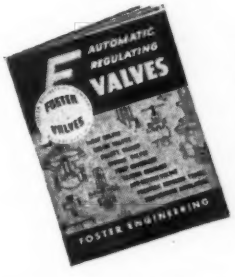


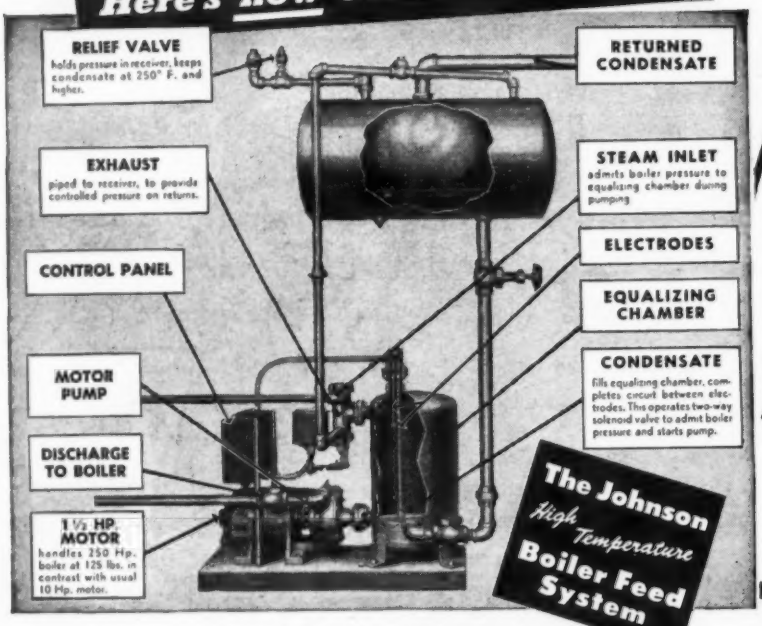
DON'T MISS these two helps — the Foster Representative and the Foster Catalog. Foster reps are trained and qualified to see that you get the proper regulator—the catalog is extremely useful in planning because it gives specifications on the various Foster valves. A 3c stamp is all it takes to tell us you want one or BOTH.

FOSTER ENGINEERING Company

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . AUTOMATIC STOP AND CHECK VALVES . . . ALTITUDE VALVES . . . DAMPER REGULATORS . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . LIQUID LEVEL CONTROLLERS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN AND TRIPLE DUTY VALVES . . . VACUUM REGULATORS OR BREAKERS . . . SIGHT FLOW BOXES . . . STRAINERS . . . SAFETY VALVES . . . SIRENS

106 MONROE STREET • NEWARK 1, N. J.

Here's how Johnson does it –


RELIEF VALVE
holds pressure in receiver, keeps condensate at 250° F. and higher.
EXHAUST
piped to receiver, to provide controlled pressure on returns.
CONTROL PANEL
MOTOR PUMP
DISCHARGE TO BOILER
1½ HP. MOTOR
handles 250 Hp. boiler at 125 lbs. in contrast with usual 10 Hp. motor.
RETURNED CONDENSATE
STEAM INLET
admits boiler pressure to equalizing chamber during pumping
ELECTRODES
EQUALIZING CHAMBER
CONDENSATE
fills equalizing chamber, completes circuit between electrodes. This operates two-way solenoid valve to admit boiler pressure and starts pump.
The Johnson High Temperature Boiler Feed System

..pays its way in one year

Admittedly the claims made for this Johnson System sound like a pretty big order. But there are hundreds of installations and plenty of sound engineering reasons, as pointed out opposite, to back them up. The Johnson System accomplishes two big things—gets condensate back to boiler at higher temperatures, and eliminates the power-consuming task of pumping against boiler pressure. In dollars and cents this amounts to power savings of as much as 60%, fuel savings up to 15%.

Available in sizes for boilers from 30 to 500 Hp., up to 200 lbs. pressure. Multiple units for larger boilers.

Write for literature and the name of your nearby Johnson representative.

Product of The Johnson Corporation

865 WOOD STREET, THREE RIVERS, MICHIGAN

WHERE TO BUY

Featuring additional products, specialties and services for power plants

BIRCH
Pump Valves

Standard in
RAILROADS, MINES, WATER WORKS INDUSTRIALS

● They increase efficiency, capacity, economy—decrease slippage, leakage, fuel consumption—will not sink in seat ports, warp, break, curl, or ride seat bridges. For hot or cold water service . . . thoroughly dependable!

BIRCH MANUFACTURING CO.
1521 Sedgwick St., Chicago, Ill.

MORPHOLINE is the Answer

. . . TO STEAM CONDENSATE RETURN LINE CORROSION

Avoid costly maintenance due to corrosion in lines returning condensed steam to the boiler! Morpholine effectively combats corrosion due to carbon dioxide dissolved in condensate. For information on this money-saving corrosion inhibitor, write Dept. M-1,

Carbide and Carbon Chemicals Corporation
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.

End Pump Troubles!
HILL IMPROVED PUMP VALVES

● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate. Send today for bulletin that tells how to get better pump performance.

HILL PUMP VALVE CO.
2728 ELSTON AVE. CHICAGO 47, ILL.

THREAD ROLLING, INC.
Precision Threads and forms.
Class 3, 4 and 5 threads,
Aviation Products - Diesel Studs - Taps - Hollow Parts, etc.
Threading after heat treating
Prompt Quotations from Blue Prints.
332 GRAND STREET, HOBOKEN, N. J.
Hoboken 4-1826.

TEST SPEEDS and SAVE.—At a glance
REVOLUTIONS and FEET per min.
SPEED VARIATIONS
BELT SLIPPAGE
Send for Bulletin
O-Z Improved Hand Tachometer-Cutmeter
O. ZERNICKOW CO.
21 Park Row New York

This
WHERE TO BUY
Section

supplements other advertising in this issue with these additional announcements of products and services essential to modern plant management and maintenance. Make a habit of checking this page, each issue.

Classified Advertising Division
POWER

Planning for... Still Higher Pressures? Still Higher Temperatures?

WHY NOT?

Temperatures and pressures measured only in hundreds were called "high" in power plant practice not so long ago. No doubt the high pressures and temperatures now in use were talked about then, but the practical boys said, "We don't need them. Besides, they aren't practical."

As time passes the new needs, new materials and new techniques which we theorize about today will be accepted as practical. When your plans require power piping to carry higher and still higher pressures and temperatures, Blaw-Knox will be prepared to fabricate and install it.

POWER PIPING DIVISION
OF BLAW-KNOX COMPANY
1525 PENNSYLVANIA AVE., N. S.
PITTSBURGH 12, PA.

POWER PIPING DIVISION
OF BLAW-KNOX COMPANY

PROFESSIONAL SERVICES

CONSULTING · DESIGN · EXAMINATIONS · PATENTS
CONSTRUCTION · PLANS · SURVEY • REPORTS · TRADE MARKS

BURNS & McDONNELL ENGINEERING COMPANY
Consulting Engineers 50th Year
Power Plants - Steam - Diesel - Hydro
Electric Systems - Rate Reports - Valuations
Water and Sewer Systems and Treatment
Box 7088, Country Club Station,
Kansas City 2, Missouri

Can Money Be Saved in Your Plant?
The specialists whose professional cards appear in this Directory, can answer that question—*are* answering it continually for other power men.

J. E. SIRRINE COMPANY
Engineers
Power Plants — Consultation
Design — Reports
Water — Steam Utilization — Plans
Greenville — South Carolina

DERBYSHIRE MACHINE & TOOL COMPANY
Manufacturing Engineers
FLUID FLOW LABORATORY
Complete Facilities
for Testing, Development and Research on
FLUID FLOW DEVICES
5217 Belfield Avenue — Philadelphia 44, Pa.

T. MASENG & ASSOCIATES, Inc.
Engineer
Electrical, Design — Structural, Reports — Mechanical Rates
7 So. Dearborn — Chicago 3, Ill.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Hershey Building — Muscatine, Ia.

DESIGN SERVICE CO.
Engineering Divisions
Structural • Mechanical • Electrical
Power plants • Industrial Plants
Commercial Buildings • Refineries
New York, Newark — Philadelphia, Cleveland

LUKE L. NAKASHIAN
Engineer
PROCESS STEAM PLANTS
POWER PLANTS
OIL REFINERY EQUIPMENT
404 Park Square Building — Boston 16, Mass.

JOHN A. STEVENS, INC.
Established 1909
CONSULTING ENGINEERS
Power Plants — Paper Mills
Dye Houses — Surveys
Lowell, Massachusetts

ELECTRIC CONSTRUCTION CO. INC.
Engineers—Contractors
Design—Erection—Maintenance
of
Power Plant, Sub Stations
Transmission and Distribution Lines
Modern Equipment
Philadelphia, Pa.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEERS
Design — Operations
Steam - Hydraulic - Gas
231 S. LaSalle St. — Chicago (4), Ill.

SYSKA & HENNESSY
Engineers
Consultation — Plans — Reports
Power Plants — Disposal Plants
Water Systems
144 East 39th Street
New York, New York

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Industrial and Utilities
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports—Examinations—Laboratory
61 Broadway, New York — 147 K St., N.W., Washington, D. C. — 17 & Sansom St., Phila., Pa.

REYNOLDS, SMITH AND HILLS
ENGINEERING CONSULTANTS
Specialists in Design and Construction of
Industrial and Central Station Plants
Reports, Analyses and Surveys
10 South Laura St. — Jacksonville, Fla.

JAMES ALLEN TUCK
Consulting Engineer
Design — Power Plants
Industrial & Utility
Diesel, Steam, Hydro
Also Central & Sub-Station
41 Park Row, N. Y., N. Y.
Phone: Barclay 7-2796

KEGARISE-CRONK ENGINEERING CORP.
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Steam and Electric Utilization
Design — Reports — Plans
334 E. Main St. *P.O. Box* 668 Johnson City, Tenn.

SANDERSON & PORTER
Engineers and Constructors
New York, San Francisco — Chicago, Los Angeles

THE J. G. WHITE ENGINEERING CORPORATION
Design-Construction-Reports-Appraisals
80 Broad Street, New York 4

LANCASTER, ALLWINE & ROMMEL
Registered Patent Attorneys
Patent and Trade-Mark Practice before U. S. Patent Office. Validity and infringement Investigations and Opinions.
Booklet and form "Evidence of Conception" forwarded upon request.
Suite 456, 815-15th St., N.W., Washington 5, D.C.

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St. Chicago, Illinois

WHITMAN, REQUARDT AND ASSOCIATES
Engineers-Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plants—Supervision—Appraisals
1304 St. Paul Street — Baltimore 2, Md.

"By reason of special training, wide experience and tested ability, coupled with professional integrity, the consulting engineer brings to his client detached engineering and economic advice that rise above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services, which do not replace but supplement and broaden those of regularly employed personnel, are justified on the ground that he saves his client more than he cost him."

The last weld!

The evolution of the modern high pressure boiler is a history of the elimination of flanged and bolted pressure joints. Improved techniques have gradually permitted the welding of all pressure connections and potential sources of leakage.

CONSOLIDATED now offers a SAFETY VALVE design which can be welded in place.

Welding the new CONSOLIDATED SAFETY VALVE in place is the last weld necessary to make the boiler a truly integral unit with no screwed or flanged connections.

This new design safety valve can be welded into position without danger of distortion or misalignment. The normal characteristics of tightness and performance which have made CONSOLIDATED SAFETY VALVES leaders in the field remain undiminished after welding.

No complicated intricate welding techniques are required to weld CONSOLIDATED SAFETY VALVES in place.

MAXWELL MANNING M&M & MOORE INC. TRADE MARK

CONSOLIDATED SAFETY VALVES

1879 CONSOLIDATED U.S.A.

A Product of

MANNING, MAXWELL & MOORE, INC.
BRIDGEPORT 2, CONNECTICUT

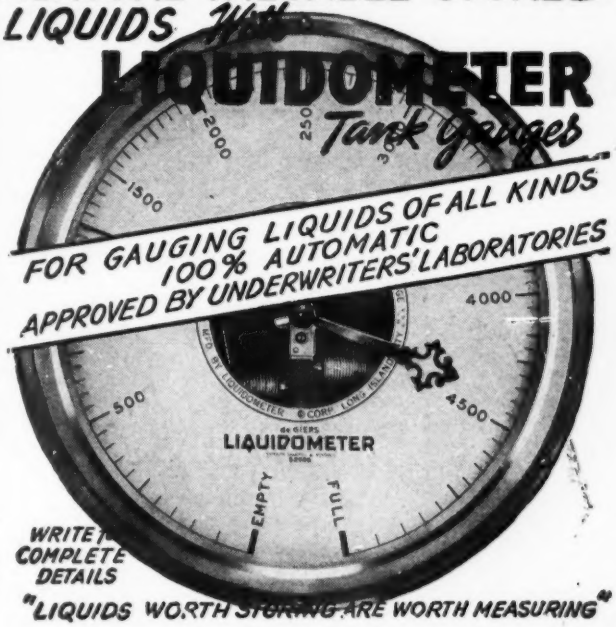
Makers of Consolidated Safety and Relief Valves, 'American' Industrial Instruments, Hancock Valves, Ashcroft Gauges

---

COSTLY HUMAN ERRORS ELIMINATED WHEN YOU MEASURE VALUABLE STORED LIQUIDS With

LIQUIDOMETER Tank Gauges

FOR GAUGING LIQUIDS OF ALL KINDS
100% AUTOMATIC
APPROVED BY UNDERWRITERS' LABORATORIES

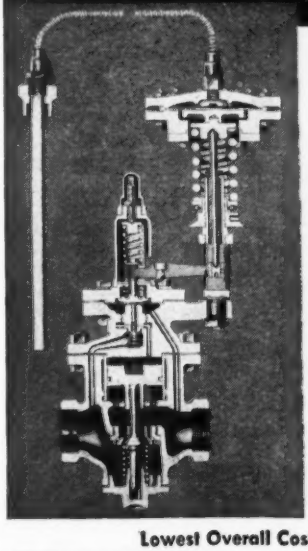


WRITE FOR COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE LIQUIDOMETER CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, L.I., N.Y.

Here's Accurate Temperature Control



This LESLIE Temperature Regulator, Class LTCO, is actually a Pressure Reducing Valve actuated by a thermostatic element.

Install the bulb in the fluid being heated and small temperature changes will actuate the vapor pressure type element automatically, changing the setting of the regulating valve, and the outlet steam pressure.

The maximum outlet steam pressure delivered by the regulator is adjustable from 10 psi. to within 15 psi. of inlet pressure.

A typical installation on a fuel oil heater controls oil temperature within one or two degrees under maximum fluctuations of demand.

Write for Bulletin 464 for the complete story.

Lowest Overall Cost per Operating Year

ESTABLISHED 1900 LESLIE CO.

LESLIE CO.
255 Grant Ave., Lyndhurst, N. J.

PRESSURE REDUCING VALVES • • PRESSURE CONTROLLERS
PUMP GOVERNORS • • • TEMPERATURE REGULATORS
SELF CLEANING STRAINERS • • LESLIE-TYFON WHISTLES

ARE YOU STILL AN ACTIVE PARTNER...

in this "7½ billion-a-year" success?

NEVER was there a partnership like the nation-wide brotherhood of volunteers who have helped sell, advertise, and promote sales of U. S. Savings Bonds! Their program is the greatest sales operation at the lowest cost in history.

Your continued support in promoting the Payroll Savings Plan will help "America's partnership" this year to repeat or surpass last year's four-star performance, in which sales of Savings Bonds were 7½ billion dollars—*exceeding redemptions by far more than a billion!*

So keep up the splendid work—keep on telling and selling your employees the advantages of Payroll Savings: (1) ease; (2) regularity; (3) safety of investment; (4) security for the individual and the nation; (5) $4 for every $3 at maturity! And, remember, people with a stake in the future are the most stable, most productive employees.

For any help you need in conducting the Plan, call on your State Director of the Treasury Department's Savings Bonds Division.

New Savings Bonds Plan won't affect the P.S.P.

THE Treasury Department and the banks of America are making it possible for farmers, doctors, and other self-employed people to participate in "automatic" Bond buying by special arrangement with their banks. This extension of the Savings Bonds program is not a partial payment plan and is intended *only* for people who are not in a position to take advantage of the Payroll Savings Plan.

The Treasury Department acknowledges with appreciation the publication of this message by

POWER

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:
(Not available for equipment advertising)
90 cents per line, minimum 4 lines. To figure advance payment count 6 average words as a line and allow 10 words for a publication box number address.
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, 75 cents a line insertion.

INFORMATION:
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
This advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. P.

NEW ADVERTISEMENTS received by September 10th will appear in the October issue, subject to limitation of space available.

POWER PLANT ENGINEER

Position available with large pharmaceutical manufacturing company in Middle West for a Power Plant Engineer. The education requirement for this opening is a degree in Mechanical Engineering with a major in steam power plant operation. A working knowledge of all power plant equipment is required.

P-1573, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED
ENGINEERS

Wanted by Michigan firm of engineers, men qualified for structural and mechanical design, drafting, and construction supervision on power plant work. Answer to

P-1281, Power
520 North Michigan Ave., Chicago 11, Ill.

POSITIONS VACANT

WATCH ENGINEERS, New England utility needs operators for turbo-electric power plant. Experience burning fuel oil essential. State qualifications and references in first letter. P-1227, Power, 330 W. 42nd St., New York 18, N. Y.

MASTER MECHANIC with operating engineer's license wanted for food plant located in New Jersey. Man with food factory experience preferred. Give complete details of experience and qualifications in your application, salary expected and when available. P-1656, Power, 330 W. 42nd St., New York 18, N. Y.

TECHNICAL GRADUATES (especially chemical, electrical) under 30, returned from military services have excellent opportunity for permanent place with nationwide engineering organization. After training period, work as junior engineer will include traveling for consultation among leading industrial plants. P-1349, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED—WATCH Engineers for power plant of a large industrial plant. A college degree is preferable, but may be offset by adequate experience, particularly in the operation and maintenance of large coal-burning boilers. P-1387, Power, 330 W. 42nd St., New York 18, N. Y.

SELLING OPPORTUNITIES OFFERED

MANUFACTURERS REPRESENTATIVES, now selling to Industrial Plants, contacting Superintendents and Power Plant Engineers, for line of Refractory Cement. No objection to other lines. Old established manufacturer. 25% commission. Write lines carried, territory covered. Sales Manager, Grip Manufacturing Co., 1532 Kater St., Philadelphia 46, Pa.

MANUFACTURER'S AGENT wanted to sell centrifugal pumps and steam turbines throughout New England. Old company with established accounts. Seek organization specializing on power equipment in position to give adequate attention to additional line. Dean Hill Pump Co., 4000 E. 16th St., Indianapolis 7, Indiana.

EMPLOYMENT SERVICES

SALARIED POSITION $2,500-$25,000. This thoroughly organized confidential service of 37 years recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

WANTED
STEAM-ELECTRIC CHIEF

Graduate Engineer, for New York consulting and designing firm, responsible charge design of steam-electric power plants, piping, electrical and sub-stations. Hydro-electric, public utility and industrial experience desirable. Please furnish detailed experience record and indicate what following of subordinates possibly available. Replies strictly confidential.

P-1293, Power
330 West 42nd St., New York 18, N. Y.

WANTED
POWER PLANT MECHANICAL ENGINEERS

Thoroughly experienced in design of modern plants and qualified to supervise engineering staff. Annual salary in neighborhood of $10,000. Location in greater New York area. Give full details of education, experience, age, availability, willingness to travel, etc.

P-1317, Power
330 West 42nd St., New York 18, N. Y.

Relay Engineer

Graduate Electrical Engineer with some experience in relay engineering, operating and maintenance or in plant and substation control work with the necessary mathematical knowledge.

Work consists of analyzing system relay operation, planning relay installations and calculating relay settings on the transmission system.

Write to Personnel Department
WISCONSIN POWER & LIGHT CO,
MADISON, WISCONSIN

POSITION VACANT

Test Engineer under 25 years of age for modern pulverized coal fired steam electric generating station in Middle West. Experience or educational background such that he can be trained to make boiler water analyses, boiler and turbine tests and miscellaneous plant tests. State salary required.

P-1529, Power
520 North Michigan Ave., Chicago 11, Ill.

DESIGNERS
MECHANICAL—STRUCTURAL —ELECTRICAL

With experience on design for Commerical and Industrial Buildings, including Chemical Plants, Power Plants and Laboratories.

MECHANICAL — Designers and checkers for Air Conditioning Pressure Vessels, Process and Power Piping, Plumbing, Sewer and Underground Piping.

STRUCTURAL — Designers for Structural Steel and Reinforced Concrete. Must be capable of checking drawings.

ELECTRICAL — Designers for Power and Lighting Layout.

Applicants for Design positions should be willing to perform board work in connection with their own designs.

Openings in our Cleveland and New York Offices.

Lengthy employment offering good salary for those who qualify.

Send complete resume stating experience, education, salary requirements and date of availability to either of the following addresses

THE H. K. FERGUSON COMPANY
Engineers and Builders
FERGUSON BUILDING
East 11th and Walnut, CLEVELAND, OHIO
or
19 Rector Street, New York, N. Y.

SALES REPRESENTATIVE

Salary basis, for New York City and vicinity. Age under forty. Must have experience in sale of accessories for steam plants or similar position requiring acquaintance with power boiler operation and maintenance. Rare opportunity for salesman with executive aptitude to affiliate with thirty-year-old manufacturer. *Write Sales Manager.*

THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Boston 36, Massachusetts

SEARCHLIGHT SECTION

WANTED

ENGINEERS

Wanted by Michigan firm of engineers, men qualified for structural and mechanical design, drafting, and construction supervision on power plant work. Answer to

P-276, Power
520 North Michigan Ave., Chicago 11, Ill.

MANUFACTURERS' REPRESENTATIVE

Well organized and financed

Electrical, Mechanical and Chemical Engineer personnel

Years of merchandising and field construction experience

INDUSTRIAL AND CONSTRUCTION EQUIPMENT AND MATERIAL ACCOUNTS DESIRED

Many established contacts among U. S. and Latin American commercial and industrial firms, U. S. Federal Government Bureaus and foreign embassies

AMERICAN ENGINEERING EQUIPMENT CORP.

P. O. Box 186, Alexandria, Virginia

REPRESENTATION IN PACIFIC NORTHWEST AVAILABLE

STEAM-DIESEL-ELECTRICAL

We may have the qualifications to represent you to your advantage in this area. Let us send you full information.

J. H. Wigen L. M. Cummings
Engineers
216 MUTUAL LIFE BLDG.
SEATTLE 4, WASH.

UNUSUAL MANUFACTURING OPPORTUNITY

Unique small air-conditioning unit, 150 c.f.m. to sell users at unprecedented low price—under $26. Designed for low cost mass production. 250,000 units yearly sales anticipated. Patent pending. Qualified manufacturer may obtain exclusive license to make and sell in U. S.

BO-1608, Power
330 West 42nd Street, New York 18, N. Y.

INDUSTRIAL ENTERPRISE

• WANTED

Large financially powerful diversified organization wishes to add another enterprise to present holdings.

CASH PAID — For Capital Stock or Assets

Existing personnel normally retained
STRICTLY CONFIDENTIAL

Box 1234, 1474 B'way, N. Y. 18, N. Y.

EMPLOYMENT SERVICE

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 109 Church Street, New Haven, Conn.

POSITIONS WANTED

TWENTY-FIVE years intensive experience in engineering is available to a progressive company. The field covered includes special machinery and equipment for food, oilfields, chemical and hydraulic applications. The positions held range from designer and estimator to chief engineer and manager. The applicant has a reputation for ability, integrity and conscientious application. Either a medium size or small company would suit and participation is desirable. PW-1413, 330 W. 42nd St., New York 18, N. Y.

CHIEF ENGINEER, Centrifugal Pumps, 30 years experience in this specialty. Wide experience in practically all types from small close-coupled units to large mine pumps, boiler feeders, etc. Prefer firm wanting highly productionized new lines, or manufacturer of associated equipment desiring this additional product. Eastern location. PW-1419, 330 W. 42nd St., New York 18, N. Y.

FOR SALE

Excellent like new 3 chime solid brass Lunkenheimer best make Steam Whistle 6x18" from former brewery. Gaines, Glencoe, Minn.

LEGAL NOTICE

Notice is hereby given that sealed bids will be received at the Office of the Clerk of the Board of Trustees of Public Affairs of the Village of Wellington in the Town Hall, Wellington, Ohio, until 12:00 o'clock noon on the 4th day of October, 1947, and then publicly opened and read, for the sale of the following property, F.O.B. Wellington, Ohio.

One (1)—Boiler, B&W Make Sterling type, 425 lb. pressure, 5160 sq. ft. of heating surface excluding water walls. Class 250 # 20.

One (1)—Stoker, Riley make, Harrington Moving Grate type, 121 sq. ft. grate area, Dual Drive.

One (1)—Forced Draft Fan, Clarage make, # 2 Type W—13650 CFM with Vortex Control, Dual Drive.

Two (2)—Boiler Feed Pumps. Ingersoll-Rand Make. Centrifugal 150 GPM. 1320 ft. head—550 lb. gauge discharge—12 ft. lift.

All of the above constitutes property of the Village of Wellington, Ohio not required for municipal purposes and authorized to be sold by Council of the Village of Wellington, Ohio.

Each bid must contain the full name of each person or company interested in bidding on the same and be accompanied by a certified check on some solvent bank in the sum of not less than ten percent of the bid as a guarantee that if the bid is accepted a contract will be entered into and its performance properly secured. Should any bid be rejected such check will be forthwith returned to the bidder, and should any bid be accepted such check will be returned upon the proper execution and securing of the contract.

Said property to be sold and conveyed to the highest bidder by bill of sale on the following terms; Cash on day of sale.

Further information concerning specifications and drawings can be secured from the Clerk of the Board of Trustees of Public Affairs.

The right is reserved to reject any and all bids.

By order of the Board of Trustees of Public Affairs, Wellington, Ohio.
JOHN DUFF, *Clerk*. C. L. HILL, *President*.

Don't forget the

BOX NUMBER

When answering the classified advertisements in this magazine don't forget to put the box number on your envelope. It is our only means of identifying the advertisement you are answering.

WANTED

WANTED

Wanted New York City complete 1100 Kw plant. 2—400 Kw, 1—300 Kw, 60 cy, 3 ph, 4 wire, turbo, steam or Diesel engine generators. Voltage 2300 or 220 80% P. F. Preferably 1—400 Kw turbo generator noncondensing, 150 lbs. initial and 15 lbs. back pressure. One condensing unit 400 Kw. Could use 500 Kw units. The 300 Kw unit could be either condensing unit or Diesel medium speed. Also required swbd, piping, condensers and auxiliary equipment for a complete plant. If 2300 volt units are offered then 13—100 KVA transformers will be required. Also another location: 3—60 cy, 3 ph pnits, size 1000 Kw units or 2—1000 and 1—600 Kw, also 4 boilers 225 lbs., 30,000 #/hr each; piping, swbd, wiring connection, auxiliary equipment, condensers for 1000 Kw, etc.

PERCIVAL R. MOSES & ASSOCIATES
11 Park Place, N. Y. 7, N. Y.

MOTORS • GENERATORS
TRANSFORMERS
25 cy. 60 cy. D.C.

ALL VOLTAGES
1-1500 H.P.
NEW and REBUILT
BOUGHT and SOLD
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

WANTED

One M. G. Set

150-200 K.W.—125 Volt, Compound Interpole D.C. Generator—Driven by 220-3-60 Synchronous A.C. Motor of suitable size. Manual reduced voltage starter, suitable accessories acceptable.

OHIO VALLEY GENERAL HOSPITAL
Wheeling, West Virginia

WANTED

TWO (2) DIRECT CURRENT MOTOR
175 H.P., type DMC class 209 500 RPM form L 230 volts. Reply

W-1271, Power
330 West 42nd St., New York 18, N. Y.

Additional "Wanted" Advertisements on page 355

FAMOUS WORDS IN THE ELECTRICAL INDUSTRY:

"Successful Operation Guaranteed"

WHAT MORE CAN YOU ASK?

RE-NU-BILT EQUIPMENT

RE-NU BILT BELYEA MOTORS

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1000 K Whse. 600 V. D.C., to 1400 HP. 2300/4000 V. Syn. Motor.
1—1000 KW Al. Ch. 450 V. d.c. to 1250 Kva 2300 V. Syn. Motor.
1—600 KW G.E. 3 unit with 2-300 KW 250 v. Gens. d.c. to 850 HP, 2300 v.
1—500 KW G.E. 600 V. d.c. to 700 HP—13200
1—500 KW G.E. 250 V. D.C., to 700 HP., 2300 V., Ind. Motor.
1—400 KW G.E. 3 Unit with (2) 200 KW 125 V. d.c. to 600 HP—2300 v. Syn.
1—400 KW Whse. 250 V. d.c. to 600 HP—440 V. Syn. with exciter.
1—300 KW G.E. 550 V d.c. to 435 HP—2300/4000 Syn. with exciter.
1—250 KW G.E. 275 V d.c. to 350 Kva 2300/4000 Syn. with exciter.
1—250 KW Al. Ch. 250 V. d.c. to 340 Kva—2300 V.
1—200 KW G.E. 125 V. d.c. to 300 HP 440 V. Syn. with exciter.
1—150 KW Whse 250 V. d.c. to 250 Kva. 440 V. Syn. with exciter.
1—150 KW Whse 600 V. d.c. to 225 HP—2300 V.
1—75 KW G.E. 125 V. d.c. to 120 HP—4000/2300 V. Ind.
1—60 KW Cr. Wh. 250 V. D.C., to 100 HP. 220/440 V. Ind. Motor.
2—48—KW G.E. 3 unit with (2) 24 KW, 60 V. gens. d.c. to 75 HP, 440 V. Ind.
1—35 KVA Whse. 240v., 3 ph., 60 cy. A.C. gen. with 35 HP—230 V. d.c. motor.

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V. 3 ph. 25 Cy. Motor and 1000 KW—2300 V—8 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—840 KW—GE—2 unit with 2 exciters consisting of 1700 HP—2300 V. 3 ph. 25 cycle motor and 1200 Kva.—.7 pf. 2400 V. 3 ph. 60 cycle gen.

1—600 KW—GE—2 Unit Consisting of 850 HP—2300 V—3 ph. 25 Cycle Motor and 750 Kva.—.8 pf.—2300 V—3 phase—62½ cycle generator.

ROTARY CONVERTERS

60 cycle

KW	Make	Speed	Volts	Volts
1—1500	Whse.	720	600	2300
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600
1— 500	Whse.	1200	600	13200

TURBO-GENERATOR SETS

1—5000 KVA G.E. 2300 V. 3 ph. 60 cy. with G.E. 435 lb. Condensing turbine.
1—3000 KW Whse. 3750 Kva. 2300 V. 3 ph. 60 cy with Parsons 200 lb. Cond. turbine.
1—3000 KW G.E. 3750 Kva. 2300 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
1—2500 KW G.E. 3125 Kva. 600 V. 3 ph. 60 cy. with 200 lb.; 15 lb. auto extraction turbine.
1—2000 KW G.E. 6600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.
1—2000 KW G.E. 3125 Kva. 480 V. 3 ph. 60 cy. with 175/200 lb.; 25 lb. auto extraction.
1—1500 KW G.E. 1875 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

SPECIAL

1—1500 KW G.E. Non-Condensing 160/175 lbs. ISP-5/10 B.P. with 1875 KVA-480 V. 3 ph. 60 cy. gen. and direct connected exciter.

2—1250 KW G.E. 1560 Kva. 2300 V 3 ph. 60 cy. with G.E. 175/200 lb. Condensing turbine.
1—1250 KW G.E. 600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.
1—1250 KW Al. Ch. 1560 Kva. 2300 V. 3 ph. 60 cy. with 200 lb. Condensing turbine.
2—1000 KW G.E. 1250 Kva.—2300/4100 V. 3 ph. 60 cy. with G.E. 135/175 lb. Cond. turbine.
1—500 KW G.E. 625 Kva.—240/480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 80/100 lb. Cond. turbine.
1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E 200 lb., 10 lb. back pressure turbine.
1—300 KW Al. Ch. 120/240 V. d.c. geared to Whse. 440 lb. Cond. turbine.
1—200 KW G.E. 600 V. 3 ph. 60 cy. with 150 lb. non cond. turbine and exciter.
1—125 Kva. G.E. 2300 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.
1—100 Kva. Whse. 2400 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.
1—100 KW G.E. 600 V. 3 ph. 60 cy. with 200 lb. non-cond. turbine and exciter.
4—60 KW Whse., Condensing, 200 lbs. with 60 KW, 120 V. D.C. Gen.

SPECIAL

500 HP — GE — KF-559 — 3575 RPM — 2300 Volt Sq. Cy. Motor connected to Byron Jackson 325 GPM—10 stage 3500 ft. head pump.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—2100	G.E.	ATI	2300/4600	514
2— 600	Al. Ch.		2300	720
1— 600	G.E.	TS-7640	2300	900
1— 600	G.E.	ATI	600	900
2— 350	G.E.	TS	2200	150
1— 300	Whse.		600	600
1— 200	El. Mach.		440	900
1— 200	G.E.	TS-965	2300	720

SLIP RING

1—1000	Whse.	CW	2300	705
1— 750	Whse.	CW	2200	327
1— 450	Cr. Wh.	SR-310	2300	392
1— 450	G.E	I	440	506
1— 350	G.E.	MT-442Y	2200/4000	253
1— 250	G.E.	MT-424Y	4000	257
1— 100	Al. Ch.	ANY	220	435

SQUIRREL CAGE

1—800	Whse.	CS-1221A	2200	706
1—250	G.E.	IK	440	600
1—250	Al. Ch.	AN	220	1160
1—150/70	G.E.	IK	440	1170/870
1—100	G.E.	IK (Vert.)	2300	450
3—100	G.E.	IK	2200	600
1—100	Al. Ch.		2200	1755

SPECIAL
MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V. D.C. Form C with 2300 V. 60 Cycle transformer and switching equipment.

1—500 KW—GE—Type RHW — 6 Anode 575 V. D.C. Form B with 2300 V. 60 Cycle transformer and switching equipment.

D. C. MOTORS

HP	Make	Type	Volts	Speed
2—800/1000	Whse.		450	600/720
1—800	G.E.	MPC	600	600
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	250	115/145
2—350	G.E.	MPC	250	450
1—335	Whse.	MQ	250	300 900
1—300	G.E.	DMC	230	400/600
1—300	G.E.	MPC	230	275/550
1—250	G.E.	MPC	230	400/500
1—150	G.E.	MPC	230	250/450
1—130	Cr. Wh.	CMC-51H	550	1200
2—125	G.E.	CO-1832	230	625
1—125	Whse.		240	240 600

D. C. GENERATORS

KW	Make	Type	Volts	Speed
1—1200	Al. Ch.	MHC	525	750
1— 300	G.E.	MPC	250	525
1— 155	G.E.	MPC	250	720
1— 150	G.E.	MPC	125	200
2— 100	Whse.		240	250

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MOTORS, GENERATORS, M-G SETS
Pumps, Fans, Speed Reducers, Controls.
The CHOICE of MEN *WHO KNOW!*

M-G SETS

Others available—special units built to order

KW	Mfr.	Input V.	Output V.
200	Gen. Elec.*	220/440 AC	125 DC
150	Gen. Elec.	220/440 AC	125 DC
75	Cr. Wheeler*	220/440 AC	125 DC
50	Whse.	220/440 AC	250 DC
37½	Whse.	230 DC	3 ph. 240 AC
35	Gen. Elec.	220/440 AC	48 DC
30	Gen. Elec.	220/440 AC	125 DC
30	Marbie Card	220/440 AC	60 DC
15	Star New	220/440 AC	125/250 DC

* Synchronous motor drive

D.C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
180	G. E. encl.	CL	230	800
100/150	G. E. dynamon.	TLC	250	1000/3500
75	Whse.	S13L	125	475
75	G.E.	BRC	115	1150
65	G.E.	C	230	375/750
60	G.E. b.b. (2)	CDM103	230	1750
50	Cr. Wheeler (2)	50H	230	700
50	G.E.	LC	230	700
60	Diehl dynamon.	R10	250	500/2000
35/50	G.E.	CD123	230	575/1150
50	Whse. b.b.	SK133	230	1150
45	P & H crane (2)	14X	500	440
40	G.E.	LC	230	700
25	Roth	RS	230	1750
25	G.E.	DLC	230	750
25	Whse. encl.	SK160	230	600
25	G.E. b.b. New	CDM93	115	1150
20	G.E. b.b. New(2)	CDM83	115	1750
20	Imp. int. dty.	D37	230	1200
20	Reliance	T	230	850
20	G.E.	LC	230	575
20	G.E.	DLC	230	500/1500
20	P & H crane	10½X	500	625
15	G.E. b.b. New(2)	CDM67	115	1750
15	G.E.	RC29	230	1700
15	Roth	RS	230	1750
15	G.E. b.b. New	CD83	230	1200
15	Whse. New	SK83	230	1150
15	G.E.	RC10	230	1150
15	Whse. (6)	SK90	230	825
15	L. Allis b.b.	ONW444	230	575/1725
15	G.E.	LC	230	550
10	Marbie Card	b.b.	230	3450
10	G.E.	CD73	230	1750
10	Allis Ch. (5)	E80	230	1150
10	G.E. b.b. New(2)	CDM66	115	1750
10	Whse. crane	K-4	230	1070
10	Whse. b.b.	SK83	230	850
10	G.E.	CD83	230	850
10	Star b.b. New(2)	SQ20	230	900
10	Whse.	SK90	230	600
10	Whse. (2)	SK80L	230	500/1000
10	Reliance b.b.	92T	230	450/1800
10	G.E.	RF	230	400/1600

D.C. GENERATORS

KW	Mfg.	Type	Volts	Speed
300	G.E. 1 brg.	MPC	125/170	1150
150	G.E.	CL	250	900
100	G.E.	TLC	250	1100
75	Whse.	S	125	600
70	Whse.	S13L	250	575
50	Cr. Wheeler (2)	CCD	250	850
30	Lincoln b.b. 600 amp.		50	1200
24	Whse.	SK	600	850
25	G.E. b.b. New	CD93	125	1450
20	Allis Ch.		125	475
15	Imperial	HV	250	1450
12½	Engberg b.b.	MR	250	1150

SPECIAL BARGAINS

Centrifugal pumps up to 10 inch. Fans & blowers, all sizes, new & used. Oilgear pressure pumps, 100 gpm, 1100 #. Coolant pumps & rotary gear pumps.

A.C. MOTORS—SLIP RING

3 phase 60 cycle 220 or 440 volts

Qu.	H.P.	Mfr.	Type	Speed
1	400	G.E. 3 brg.	I-P	450
1	400	Allis Ch. 2200 v.	ANY	514
1	300	G.E. 2200 v.	I-M	1800
1	200	G.E.	IM-E13B	1800
1	200	G.E.	IM-E15	1200
1	200	Whse. 3 brg.	HF	600
1	200	G.E. 2200 v.	I-M	600
1	200	G.E.	I-M	514
1	100	Whse.	CW761C	1800
1	75	Whse.	CW	1200
1	75	G.E. b.b.	MT	1200
1	75	Whse.	HF	720
1	60	Howell	SR	1800
1	60	Ideal 2200/4000 v.	A	1800
1	60	G.E.	MT	1200
1	40	Allis Ch.	ARY	1200
1	40	Whse.	CW	900
1	40	Allis Ch.	ANY	450
2	37	G.E. int. duty	ITC	1200
1	37	G.E. int. duty	ITC	600
1	35	Lancashire	b.b.	1800
1	30	G.E.	OMT336	1200
1	30	Whse. int. duty	CI	900
1	30	Allis Ch.	ARY	1200
1	30	G.E.	MT346	600
1	25	Triumph	SR	1200
1	25	G.E.	I-M	900
1	20	P & H int. b.b.	WT8	1200
1	15	P & H int. b.b.	W-7	1200
1	15	G.E.	I-M	900
1	15	Watson	KHV	720
2	10	Century New b.b.	SRT326	1200

A.C. MOTORS—SQUIRREL CAGE

3 phase 60 cycle 220 or 440 volts

Qu.	H.P.	Mfr.	Type	Speed
1	400	G.E. 2200 v.	I-K	1800
1	250	G.E. 2200 v.	I-K	600
2	150	F. Morse	B	600
1	125	Cont. 2200 v.	SC	1800
1	125	Whse. 2200 v.	CS505	3600
1	125	Northwn.	H	1800
1	125	Cr. Wheeler	125Q	900
1	100	G.E.	I-K	600
1	100	Whse. vertical	CS	1200
1	75	G.E.	KT329Y	3600
1	75	G.E. 2200 v.	I-K	514
1	60	Howell b.b.	SC	1800
8	60	G.E.	K505	1200
1	60	Ideal	A306	1200
1	60	G.E.	KT346	900
2	50	G.E.	I-K	1200
2	50	G.E.	I-K	900
1	50	G.E.	KT342	900
1	50	Whse. New b.b.	CS445	1200
2	50	Whse. vertical	CS766	900
1	40	G.E.	KT332	1200
1	40	G.E.	I-K	1200

SPECIAL

50 H.P. Gearhead Motor

Howell b.b. 2 speed 1800/900 RPM 3/60/440 V. with D.O. James spur gear reduction, output 158/79 RPM like new

▼

Also many speed reducers & gear motors in stock up to 15 H.P., new & rebuilt, at various speeds.

A.C. MOTORS—SQUIRREL CAGE

Qu.	H.P.	Mfr.	Type	Speed
2	40	G.E.	I-K	900
1	40	Allis Ch. 3 spd.	ARX	900/600/450
1	40	Whse.	CCL	720
2	35	G.E.	I-K	720
2	30	Howell b.b. 4 spd.	SC	1800
1	30	Whse. New b.b.	CS405	1200
1	30	F. Morse	BH	600
2	25	Whse. New spl. b.b.	CS365	1800
2	25	U. S. b.b.	SC364	1800
1	25	G.E.	I-K	1200
1	25	Whse. New splprf.	CS405	1200
8	25	Whse.	CS586C	900
1	25	G.E.	KT526	900
2	25	G.E.	I-K	600
2	20	U. S. New b.b.	SC326	3600
1	20	G.E.	KT182	3600
2	20	Whse. New TEFC	CS364	1800
4	20	Delco New TEFC	C364	1800
3	20	Whse. New splprf.	CS364	1800
2	20	Century 4 spd. b.b.	SC504	1800
1	20	Wagner	19TBW	1200
2	20	G.E.	I-K	1200
2	20	F. Morse	BH12B	900
2	20	G.E.	I-K	720
1	20	Whse. vertical	CS	1200
4	15	G.E. New b.b.	K324	3600
4	15	Whse. New b.b.	CS326	1800
3	15	Whse. New b.b.	CS364	1200
1	15	American b.b.	HN326	1800
2	15	G.E.	KT182	1800
1	15	F. Morse vertical	Q326	1800
3	15	G.E. splprf. b.b.	K365	1200
2	15	Whse. b.b.	CS365	1200
5	15	G.E.	KT302	1200
3	15	Whse. TEFC b.b.	CS365	1200
2	15	G.E.	KT512	900
1	15	Allis Ch.	AR217	720
1	15	G.E.	I-K	720

A.C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
300	G.E.	ATI	220/440	600
300	El. Machy.	late	2200	360
225	KVA-G.E.	ATI	220/440	900
125	G.E. spl. New	TS955	220/440	1200
125	Whse.	G	2200	900
100	KVA-Cr. Wheeler		220/440	900
75	El. Machy.	BRKT	550	900
60	El. Machy.	BRKT	220/440	1200

A.C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Speed
450	Whse. 2200 v.	CW slipring	750
150	Whse.	HF slipring	500
150	Whse.	C sq. cage	500
100	Whse.	CCL sq. cage	500
50	Allis Ch.	ANY slipring	1500
50	G.E. int.	MTC-5537	750
25	Howell	SR slipring	750
25	Whse. (4)	C sq. cage	750
20	Whse. (5)	C sq. cage	750
15	Whse. (3)	C sq. cage	750

A.C. GENERATORS—60 CYCLE

KVA	Mfr.	Type	Volts	Speed
625	G.E.	ATB	2300	450
500	G.E.	ATB	2300	450
250	G.E.	ATB	240/480	600
225	G.E.	ATB	240/480	900
200	G.E.	ATB	240/480	600
150	Allis Ch.	B	2300	900
150	Allis Ch. 25 cycle	B	240/480	500
100	Whse.	G	2300	900
100	Whse.	G	240/480	900
100	Cr. Wheeler	103S8	240/480	900
100	Cr. Wheeler		240/480	600
75	Triumph	A15L	240/480	900
50	El. Machy.	BRKT	240/480	1200
25	Whse. b.b. like new	1 phase	120	900

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MOTOR GENERATOR SETS

1—125 KW Crocker Wheeler 125 V, 1200 RPM, 2300 V., Squirrel Cage.
1—100 KW Elec. Mach. 125 V., 1200 RPM, 4150 volt, synchronous.
1—100 KW General Electric, 230 v., 900 RPM. TS 4150 v. syn.
1—50 KW Ridgeway 1200 RPM, 550 Volt, Motor Sq. Cage, 220 volt.
1—5 KW General Electric, AC Gen. 1800 RPM. 120-volt, single phase, DC Motor, 230 volt.
4—100 KW General Electric, 60 volt, 1200 RPM, 125 HP Squirrel cage 220/440 volt.

ENGINE GENERATOR SETS

1—150 KVA General Electric, Ames Uniflow 220 volt, 3 phase, non-condensing.
1—62½ KVA Westinghouse 240 volt, 3 phase, Fairbanks non-condensing.
2—13 x 15 Uniflow Engines 150/300 RPM for Ice Compressors.
1—200/273 volt Gasoline Van Bierck 8 cyl. 1500 RPM.

TURBO GENERATOR SETS

1—300 KW General Electric ATB 240 Volt, 3 phase, condensing.
1—30 KW Allis Chalmers 3600 RPM, 125 volt, Terry Non-Condensing.

TRANSFORMERS

3—150 KVA General Electric, Type HT, 3 phase, 27080 Primary, 125/216Y Secondary.
1—200 KVA Pittsburgh 4000 volt, single phase 110/220 volt secondary.
1—1000 KVA General Electric Auto transformer, 3 phase, 4150 volt, 2 phase, 2406 volts.
1—100 KVA, 2400 volt primary, 240/480 secondary, G. E.
2—150 KVA, 3 phase, 4320 high tension primary, 125/217 secondary, General Electric.
3—150 KVA Wagner, 440 volts primary, 120 volt secondary.
3—75 KVA, 440 to 220 primary, 120 to 240 secondary.
5—50 KVA Westinghouse, 13,800 primary, 125 volt secondary.
5—50 Westinghouse, 12,800 primary, 240/120 secondary.
2—2500 KVA, 12900 volts to 220 volts secondary.
1—100 KVA Westinghouse, 13200 volt, 250 volt, single phase.
10—27½ KVA General Electric brand new Air Cooled 440/220 220/110 single phase.
3—10 KVA Westinghouse Air Cooled, 450 volt, primary, 117 Volt secondary, single phase.
1—7½ KVA American 2200 volt primary, 230 volt, single phase.
1—7½ KVA Maloney 440 volt primary 110/220 secondary, single phase.

A. C. GENERATORS

500 KW General Electric .8 PF, 3600 RPM, ATB, 600 volts, DC exciter
240 KW General Electric .8 PF, 600 RPM, ATB, 600 volts, DC exciter
200 KVA Allis Chalmers, 3600 RPM, 240 volt, 2 phase, DC exciter.
200 KVA Westinghouse 600 RPM, 240 volt, 3 phase, DC exciter.
200 KVA Allis Chalmers, 900 RPM, 240 volt, 3 phase, DC Exciter.
180 KW Westinghouse, 514 RPM, .8 PF, 550 volt, 3 phase.
2—167 KVA General Electric, 1200 RPM, .6 PF, 450 volt, 3 phase.
165 KW Electric Machinery, 514 RPM, 2400 volt, 3 phase.
120 KW General Electric, ATB, .8 PF, 720 RPM, 2300 volt, 3 phase.
100 KW, General Electric, ATB, 600 RPM, 240 volt, 3 phase, DC Exciter.
62½ KW Allis Chalmers, 3600 RPM, 220 volt, 3 phase, DC Exciter.
35 KW Columbia Elect. .8 PF, 1200 RPM, 240 volt, 2 phase, DC Exciter.
31.3 KVA American Customs .8 PF, 1200 RPM, 120/208 volt, 3 phase, DC Exciter.
12.5 KVA Westinghouse .8 PF, 1200 RPM, 240 volt, 3 phase, DC Exciter.

SYNCHRONOUS MOTORS

200 HP Elec. Machinery, 450 RPM, 440 volt, 3 phase.
150—HP Westinghouse, 900 RPM, 4150 volt, 3 phase DC Exciter.
153 HP General Electric, T.S. 900 RPM, 4160 volt, 3 phase, DC Exciter.
106 HP General Electric T.S. 600 RPM, 440 volt, 3 phase, DC Exciter.
70 HP Electric Machinery, 180 RPM, 2200 volt, 3 phase.
40 HP Westinghouse, 1800 RPM, 220 volt, 3 phase, DC Exciter.
35—HP General Electric, 1200 RPM, 2200 volt, 3 phase, DC Exciter.
20 HP Westinghouse, 1800 RPM, .8 PF 220 volt, 3 phase.

MOTORS—3 ph. 60 cycle

SQUIRREL CAGE

1—125 HP U. S., 1200 RPM, vertical hollow shaft, 220 volt, 3 phase, 60 cycle.
1—450 HP Ridgeway 900 RPM, 2200 volt, 3 phase.
3—40 HP General Electric, Type KT, 900 RPM, 220 volt, 3 phase.
1—35 HP General Electric, Type 1, 600 RPM, 350 volt, 3 phase.
2—10 HP Westinghouse gear 440 RPM output 440 volt, 3 phase.

MOTORS—3 ph. 60 cycle

SLIP RING

1—450 HP General Electric, 425 RPM, ITC, 440 volt, 25 cycle.
1—100 HP General Electric, 720 RPM, IM, 440 volt, 25 cycle.
1—50 HP F & B, 1800 RPM, BV, 220 volt.
1—50 HP General Electric, 900 RPM, IM, 440 volt.
1—40 HP Cont. 1150 RPM, SA55, 220 volt.
1—40 HP General Electric, 1130 RPM, MT, 220 volt.
1—40 General Electric, 900 RPM, MT, 220 volt.
1—40 HP. General Electric, 900 RPM, MT, 2200 volt.

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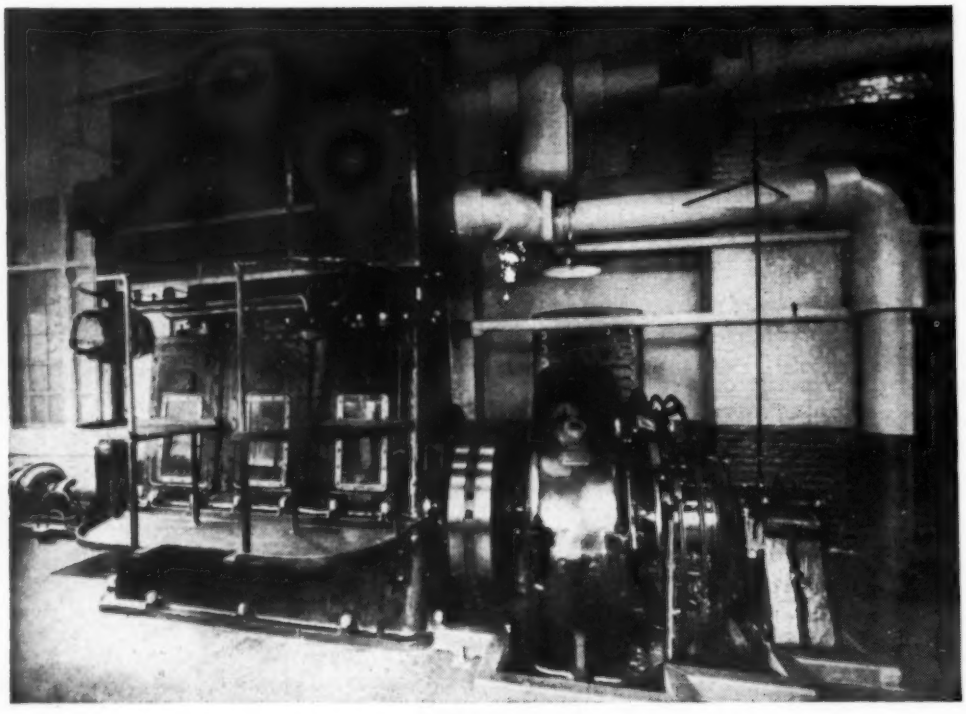
PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

400 KW DIRECT CURRENT SKINNER UNAFLOW ENGINE GENERATOR UNIT



Actual Photograph

400 KW maximum—325 KW, 35°C. Crocker-Wheeler 125 volt, 300 RPM interpole direct current generator direct connected to a 15" x 14", 3 cylinder, 300 RPM Skinner vertical Unaflow non-condensing engine, 125 to 150 lbs. pressure, 0 to 5 lbs. gauge back, complete with switchboard.

Excellent Condition

Complete Installation

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

3750 KVA G.E. 250# pressure, 4160 Volts, complete surface condenser, exciter.
2500 KVA Westinghouse condensing, 180 lbs. pressure, 2300 volts, complete surface condenser, exciter.
1875 KVA Westinghouse condensing, 175 to 200 lbs. pressure, 500°TT, 480 volts, complete.
625 KVA Westinghouse automatic bleeder condensing, 250 lbs. pressure, 20 lbs. gauge back, 480 volts, complete condenser and panel.
625 KVA G.E. condensing, 200 lbs. pressure, 2300 volts, complete exciter, condenser, switchboard.
625 KVA G.E. non-condensing 150 lbs. pressure, 15 lb. back, 2300 volts, complete exciter, panel.
125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts, with exciter, panel.
125 KVA G.E. non-condensing, 175 lbs. pressure, 10 lbs. gauge back, 2300 volts, complete
100 KVA Westinghouse non-condensing 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts.

ENGINE-GENERATOR UNITS

Alternating Current

3 phase, 60 cycle

750 KVA G.E. 2300 volts, 150 RPM generator direct connected 28" x 32" Chuse Unaflow engine.
500 KVA Westinghouse, 460 volts, 164 RPM generator direct connected 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pres.
312 KVA G.E. 480 volts, 180 RPM generator direct connected to 24" x 20" Skinner Universal Unaflow engine, 175 to 200 lbs. pressure.
225 KVA E.M. 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.
200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back.
180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18" x 21" Chuse non-releasing Corliss engine, 125 to 140 lbs. pressure.
150 KVA G.E. 240 volts, 225 RPM generator direct connected to Ames Unaflow engine.
75 KVA Allis 2300/550 or 440 volts, 257 RPM generator direct connected to 12" x 16" Chuse 4-valve non-releasing Corliss engine.

ENGINE-GENERATOR UNITS

Direct Current

500 KW Crocker Wheeler 250 volt, 300 RPM direct connected Ames unaflow vertical non-condensing engine complete.
200 KW Burke 3-wire, 250 volt, 360 RPM generator direct connected Ames 4 cylinder vertical Unaflow non-condensing engine 150 lbs. pressure, complete switchboard.
75 KW Allis-Chalmers Terry, 125 volts, 2400 RPM 150 lbs. pressure non-condensing turbine generator unit.
35 KW G. E. 125 volt, 3600 RPM non-condensing turbine-generator unit.
15 KW Crocker-Wheeler, 125 volts, 410 RPM generator direct connected to an American Blower vertical engine.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.
100 KW G.E. 125 volts, 1200 RPM direct current generator direct connected 150 HP, 3 phase, 60 cycle, 220 volts induction motor.
62½ KVA G.E. 3 phase, 60 cycle, 2300 volts, 1200 RPM alternator direct connected 75 HP, 115 volt direct current motor.
50 KW Westinghouse, 125 volt, 1200 RPM direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt induction motor.

SPECIAL BARGAIN OFFERINGS

5425 GPM Worthington 70′ head, 1800 RPM centrifugal pump direct connected 125 HP G. E. 3 phase, 60 cycle, 2200 volt slip ring motor.
1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.
187½ KVA Ideal 3 phase, 60 cycle, 240 volt, 400 RPM alternator direct connected 225 HP Buckeye Diesel.
500 KVA Westinghouse, 3 phase, 60 cycle, 600 volts, 514 RPM belted generator.
MANISTEE ROTARY JET CONDENSER 7000 lbs. steam per hour, 28" vacuum direct connected to a 25 HP, 3 phase, 60 cycle, 220 volt, 900 RPM G.E. motor.
10 TON CAPACITY BROWN HAND OPERATED TRAVELING CRANE with 31′0" span including 150′ of I-beams.
1—Allis-Chalmers jet condenser suitable for 2000 KW steam turbine-generator unit.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

SINCE 1910—EQUIPMENT THAT PERFORMS!

1 YEAR GUARANTEE

125 V. - 250 V. - 550 V. D.C. GENERATORS

(Motor Driven and Belted)

KW	Make	Voltage	Ampere	Speed
500	Al.-Ch.	250	2000	900
250	G.E.	125	2000	690
200	G.E.	125V	1600	900
200	Cr. Wh.	550	363	900
175	Cr. Wh.	250	700	1200
150	G.E.	250	600	580
150	G.E.	125	1200	1200
150	West.	250	600	1150
100	G.E.	125	800	730
100	G.E.	125	800	1150
75	West.	250	300	870
40	G.E.	250	160	1150
40	Century	125	320	1450
40	West.	250/125	160	1500
40	G.E.	250	160	800
25	Allen	110	320	500
20	Delco	125	160	1200
20	Col. (3)	125	160	1750
15	G.E.	125	120	1750
15	West.	230	60	1450
15	G.E.	125	120	1150
15	G.E.	125	120	850
10	Rogers (2)	125	80	1450
10	El. Dy.	125	80	600
8	G.E. (2)	125	64	1800
7½	G.E.	125	60	1800
5	G.E. (2)	125	40	1740
5	Rel.	250	20	1725

80—Additional generators—125 V. up to 200 V. generators in stock.

600 H.P. Westinghouse Synchronous Motor, 900 RPM, 3 ph. 60 cy. 2300 volts Complete Manual Red. Volt. Starting—Latest type

LOW VOLTAGE D.C. GENERATORS

KW	Make	Voltage	Ampere	Speed
105	West.	75	1500	1150
75	G.E.	75	1000	1145
22½	West.	75	300	720
90	Century	60	1600	1150
1-½	G.E.	60	19	1800
3	Hertner	60	60	1730
40	G.E. (6)	50	800	1160
3½	G.E.	42	205	1800
5	Diehl	40	125	1750
33	G.E.	33	1000	850
39	G.E.	32	1200	1750
6½	G.E.	32	205	1800
3	G.E.	30	100	1200
6	Star (2)	25	250	1800
5	Star	25	200	1750
15	Rel.	24	625	1450
4	Star	20	200	1800
1	West.	16	60	1750
11	Star	15	750	1200
1	Cont. (2)	15	67	1750
4½	Star	15	300	1800
30	Columbia	8-16	5000/2500	720
12	H.V.W.	12/24	1000/500	900
12	H.V.W.	6/12	2000/1000	720
6	Columbia	6/12	1000/500	1200

300—Additional low voltage generators in stock.

NEW MOTORS IN STOCK

1 HP. to 30 HP.
3 ph. 60 cy. 220/440 V.
1200 & 1800 RPM
Ball Bearing
Nema Frames

230 V. D. C. MOTORS

Qu	H.P.	Make	Type	Speed
1	125	G.E.	RC	1750
1	100	West.	SK-1 0	625
1	100	Rel.		475/635
1	100	Rel.	1050T	400/1200
1	75	West.	SK	475
1	75	Cr. Wh.	New	480/670
1	75	Cr. Wh.	CMC	375/750
3	60	West.	SK-160	680
1	60	G.E.	C	480/1100
1	45	Diehl	K-10	850
2	40	G.E.	DLC-25	1050
8	40	G.E.	CD1441	250/1500
1	40	Cr. Wh.	CCM	700
1	35	G.E.	RLC-204	440/800
1	35	G.E.	RF	500/1500
1	35	West.	SK-160	400
1	30	G.E.	RC-32	1100
1	30	West.	S-6	1025
1	30	West.	SA	975
2	30	West.	SA	500/1500
2	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Rel.	92T	1150
1	25	West.	SK	900
4	25	G.E.	RF-1	500/1500
1	25	West.	SK	500/1500
1	25	G.E.	RF-11	500/1500
2	25	G.E.	RF-14	300/1200
1	25	G.E.	RF-14	300/900
1	25	West.	SA	325/975
1	20	G.E.	CD-85	1150
1	20	G.E.	RC-11	1150
1	20	West.	SK-103	1200
1	20	West.	S-6	975
2	20	West.	SK-83	850
1	20	G.E.	RC	800
1	20	Al. Ch.	Series	625
1	20	West.	HY-6	700
1	20	G.E.	RF-11	500/1500
10	20	G.E.	RF-12	400/1200
2	20	Star	SHB-20	29.2
2	16/25	Cr. Wh.	35-JA	400/1200
1	15	Roeh.		3450
4	15	Star	SQ-1520	1290
1	15	G.E.	RC	1200
1	15	West.	SK-80L	1100
1	15	G.E.	RC-29	1150
1	15	G.E.	RC-10	1150
1	15	G.E.	CDC-85	900
1	15	West.	SK	850
1	15	G.E.	CDE-83	850
2	15	G.E.	RC-30	850
1	15	West.	SK	675/1350
1	15	El. Dy.	5S	600/1200

230 V. D.C. MOTORS (Cont.)

Qu	H.P.	Make	Type	Speed
1	15	G.E.	CQ	600/1500
1	15	G.E.	LC	675/1150
2	15	West.	SK-100L	600/1500
1	15	G.E.	RF-11	400/1600
1	15	West.	SK	250/1100
1	15	Diehl		200/247
1	10	G.E.	CD-75	1150
1	10	G.E.	RC	1100
1	10	Triumph	TR-10S	860
1	10	G.E.	RC-29	850
1	10	Diehl	LS-14	750
1	10	West.	SK-7L	700
1	10	Cr. Wh.	CSM	675
1	10	West.	SK	600/1200
2	10	G.E.	RLC	500/1500
1	10	G.E.	RF-10	400/1600
1	10	West.	SA	400/1200
1	10	G.E.	RF-10	400/1200
1	10	Rel.	131T	250/1000
2	10	West.	Gr. Hd.	3/10
1	7½	Sturt		3600
1	7½	L.A.	284	1750
1	7½	El. Dy.	2S	1750
5	7½	Cr. Wh.	New	1750
1	7½	G.E.	RC	1700
1	7½	West.	SK	1800
2	7½	Cr. Wh.	CCM	1425
3	7½	West.	SK	1100
1	7½	G.E.	RC	1100
1	7½	G.E.	CO-1804	1200/3200
2	7½	West.	SK-50	975
1	7½	G.E.	RC	900
1	7½	Cr. Wh.	CCM	875
2	7½	G.E.	RC	850
1	7½	West.	SK-60	850
1	8½	West.	SK-30	825
1	7½	G.E.	RF-10	600/1500
1	7½	West.	SK-90	650/1300
1	7½	El. Dy	3S	550/1650
2	7½	L.A.	BW-15	525/1150
1	7½	Roth	RS-107	450/900
1	7½	West.	SK-70	400/1600
1	7½	West.	SA	400/1600
1	7½	G.E.	RLC	400/1600
1	7½	Al. Ch.		350/1050
1	5	Star	SB-5	1750
1	5	Rel.	T-254	1750
2	5	G.E.	RC	1700
1	5	G.E.	CDV	1750
1	5	G.E.	CVC	1650
1	5	G.E.	CD-65	1150
1	5	Rel.	32T	1150
8	5	G.E.	RC-27A	1150
2	5	West.	SK-43	1150
1	5	G.E.	B-284	1150
1	5	West.	SC-3	870/1750
1	5	Rel.	23T	850/1700
1	5	Al. Ch.	E-75	800
1	5	G.E.	RC	600
1	5	Cont.	D-49	600/1800
1	5	Star	SB-10	600/1200
1	5	El. Dy.	3-S	550/1650
2	5	West.	SK-60	500/1500
1	5	Cr. Wh.	CM	400
2	3	G.E.	BD-235	3600

800—Smaller D.C. motors in stock including fractional.

3—500 H.P. Electric Machinery Synchronous Motors, 3 phase, 60 cycle, 440 volts, 514 RPM, complete with starting equipment. Latest type.

110 V. D.C. MOTORS (Cont.)

Qu	H.P.	Make	Type	Speed
1	20	G.E.	CD-83	1750
1	16	Cr. Wh.	CMC-L	1750
1	15	West.		1150
1	15	El. Dy.	7½ S	615/1230
1	15	West.	S	500
4	10	Lincoln		3500
1	10	L. A.		3500
1	10	Al. Ch.	EBC-75	2175
1	10	G.E.	CD-73	1750
1	10	West.	SK-70L	850
1	10	Cont.		825
1	10	Rel.		400/1600
1	10	Diehl.		230

600—Smaller size 110 V. D. C. motors including fractional horsepower motors also in stock.

10 V. D.C. MOTORS

Qu.	H.P.	Make	Type	Speed
1	25	Star	15-L	2400
1	25	G.E.	CDM-95	1000

NEW

Direct Current
Manual and Automatic
Starters

CUTLER - HAMMER
GENERAL ELECTRIC
WARD - LEONARD

230 Volts

164—1 H.P. Manual
24—1 H.P. Automatic
197—1½ H.P. Manual
206—2 H.P. Manual
119—2 H.P. Automatic
270—3 H.P. Manual
95—3 H.P. Automatic
343—5 H.P. Automatic
9—10 H.P. Automatic
3—20 H.P. Automatic
19—60 H.P. Automatic
50—75 H.P. Automatic

115 Volts

19—1 H.P. Manual
8—1½ H.P. Manual
8—2 H.P. Manual
23—3 H.P. Manual
398—5 H.P. Automatic
1—60 H.P. Automatic

You must BUY!
at our prices on
these starters.

SEND US YOUR INQUIRIES FOR A. C. EQUIPMENT

L. J. LAND, INC.

Established 1910 — **146 GRAND STREET, NEW YORK 13, NEW YORK** — **CAnal 6-6976**

New England Representative
BOSTON, MASS., 411 Atlantic Ave.
***Phone:* Liberty 4300**

Pennsylvania Office
READING, PA., 10th & Exeter Sts.
***Phone:* Reading 2-6866**

AVAILABLE FOR IMMEDIATE SHIPMENT

UNIFLOW ENG. GEN. SET

1—300 kw Chuse vertical Uniflow engine generator set 6 cyl. 10 x 12 150# pressure O# B.P. 450 RPM direct connected to 300 kw G.E. Alternator 3-60-2300 v. with D.C. exciter 125 v. Excellent condition. Rebuilt 1945. Reasonably priced for quick sale.

SKINNER UNIFLOW SET

1—300 KVA Skinner Uniflow Engine Generator Set 150# ISP 0-5# BP direct connected to Burke Alternator 3-60-480 v. 200 RPM with Exciter and Control Panel.

TURBINE

1—710 H.P. Terry Turbine, type GF, 3531 RPM, complete with reduction gear to 1000 RPM, 145# pressure, 0.60# B.P.

AIR COMPRESSOR

1—Chicago Pneumatic Air Compressor, air cooled, 2 stage, 277 CFM displacement at 125 PSI with Receiver V-belted to 50 HP General Electric Motor 3-60-220-440 volt with control.

DIESEL ENGINES

1—150 H.P. Hercules 6 cyl., model DWXDS, 4¼ x 4¾.

3—68 H.P. Buda 6 cyl., model 6LD 468, size 4¼ x 5½.

AIR RECEIVERS

1—5' diam. x 14', Vertical.

1—6'2" diam. x 20'6", Vertical.

PUMPS

1—400 GPM, 635' head, Ingersoll Rand Centrifugal Pumps, size 3-GT, 3550 RPM, 350# hydro. test.

2—500 RPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—4500 GPM, 135' head, LeCourtney Centrifugal Pump, 1800 RPM.

2—520 GPM, 50' head, DeLaval Centrifugal Pump, 1150 RPM.

5—Worthington, 2⅜" x 18" Horizontal Duplex Double Acting, cap. 133 GPM, 3500# W.P.

CARRIER AIR CONDITIONING UNIT

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 HP Motors mounted on common base; with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3-60-220-440. New 1942. Has been in use one season.

FLANGED GATE VALVES

Stainless Steel. Sizes 1" to 6".
Iron Body. Sizes 2" to 14".
Cast Steel. Sizes 2½" to 16".

NEW HOISTS

75 Yale & Towne 2 ton Chain Hoists. 20' lift. BRAND NEW in Original Packing.

MOTORS

1—300 H.P. Westinghouse Type CS, 2200 Volt, 3 phase, 60 cycle, 600 RPM with Control.

1—200 H.P. G.E. Synchronous Motor 3/60/4150, 600 RPM with starting panel, V-Belted exciter. New 1943.

1—125 H.P. West. Squirrel Cage, 3-60-2200 v., 1800 RPM and Starter.

1—20 H.P. General Electric Induction Motor, 3-60-220 v. 1160 RPM.

5—Vertical Gear Head Motors, Crocker Wheeler TEFC 10 H.P., 220°440 Volt, 60 cycle, 3 phase, 1745 RPM, Philadelphia Gear, output 425 RPM.

TRANSFORMERS

1—7½ KVA G. E., 460/230-115 v.

1—10 KVA G.E., 2400-4160/240-480 v.

3—20 KVA West. 450-117 v. New.

6—25 KVA West., 450-117 v. New.

3—37½ KVA G. E., 4000/2300 v.

1—100 KVA West., type S, 4370-4160-3950/208-120 v.

1—333 KVA West., type SL, 4160/480 v.

1—500 KVA West., type SL, 4160/480 v.

300 AND 400 AMPERE ELECTRIC MOTOR DRIVEN ARC WELDERS

Lincoln—Hobart—General Electric
Reconditioned—Guaranteed—New 1943

MISCELLANEOUS

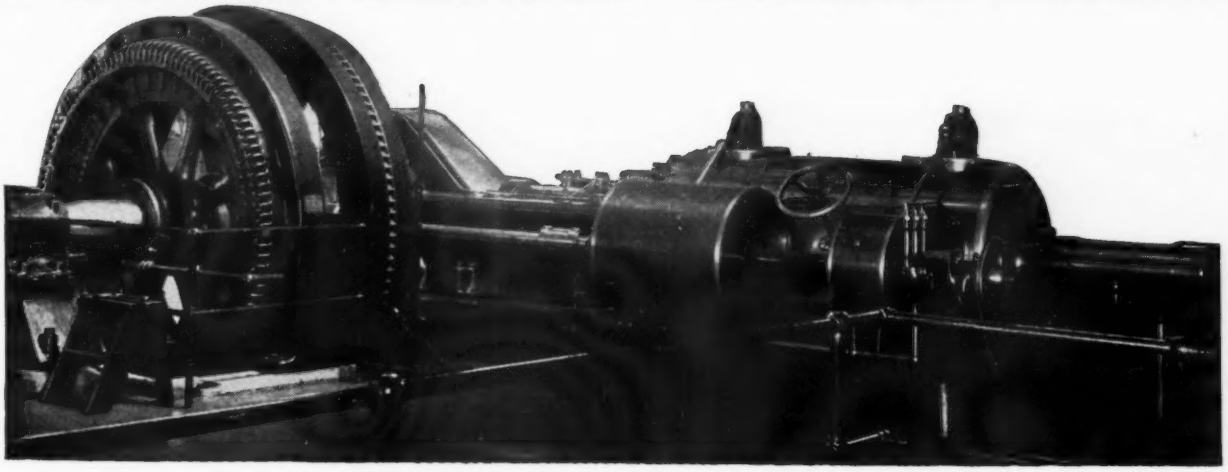
1—3600 sq. ft. C. H. Wheeler Surface Condenser.

7—Buffalo Steel Plate Blowers, 40", type R, with Everdur Blades.

Heat and Power Co., inc.

70 PINE STREET | WHITEHALL 3-2172 | NEW YORK 5, N. Y.

POWER PLANT MACHINERY



750 KVA NORDBERG UNIFLOW ENGINE GENERATOR UNIT

600 KW 80% P.F. 750 KVA General Electric alternating current generator 3 phase 60 cycle 4000/2300/600/480/240 volts 150 RPM direct connected to Nordberg uniflow noncondensing engine, 150-200# steam pressure, 0-15# back pressure. This unit is in excellent condition, available for immediate delivery.

CONDENSING TURBO UNITS

3 phase 60 cycle

5000 KVA G.E. 2400 volts 200# steam
3750 KVA Wstgh. 4160 volts 200# steam
2500 KVA G.E. 600 volts 150# steam
2500 KVA Allis 2400 volts 200# steam
2250 KVA G.E. 480 volts 250/400# steam
1875 KVA G.E. 480 volts 225# steam
1563 KVA Allis 2400 volts 200# steam
1250 KVA G.E. 600 volts 250# steam
1250 KVA G.E. 2400 volts 175# steam
937 KVA G.E. 480 volts 150# steam
375 KVA G.E. 480 volts 400# steam

NONCONDENSING TURBO UNITS

3 phase 60 cycle

2500 KVA G.E. 480 volts 150# steam, 15# exhaust
1250 KVA Wstgh. 2400 volts 300# steam, 5# exhaust
937 KVA Moore 2400 volts 175# steam, 20# exhaust
750 KVA G.E. 480 volts 115# steam, 5# exhaust
625 KVA Wstgh. 480 volts 300# steam, 10# exhaust
375 KVA G.E. 240 volts 150# steam, 10# exhaust
250 KVA G.E. 480 volts 200# steam, 5# exhaust
250 KVA G.E. 600 volts 150# steam, 5# exhaust
187 KVA Wstgh. 240 volts 125# steam, 25# exhaust
110 KVA Allis 240 volts 150# steam, 5# exhaust

EXTRACTION TURBO UNITS

3 phase 60 cycle

3750 KVA Wstgh. 2400 volts 150# steam, 10# extraction
2500 KVA G.E. 600 volts 225# steam, 20# extraction
1875 KVA G.E. 480 volts 225# steam, 15# extraction
1250 KVA Allis 480 volts 300# steam, 35# extraction
625 KVA Wstgh. 480 volts 250# steam, 25# extraction

UNIFLOW UNITS

3 phase 60 cycle

750 KVA Skinner, 2400 volts, 175# steam, 15# exhaust
375 KVA Skinner, 2400 volts, 150# steam, 5# exhaust
240 KVA Ames, 240 volts, 125# steam, 5# exhaust
200 KVA Skinner, 240 volts, 125# steam, 5# exhaust
187 KVA Ames (vertical) 240 volts, 150# steam, 5# exhaust

BOILERS

60,000 lbs/hr Springfield 225 lbs. steam, 500 deg. T. T. pulverizer
37,500 lbs/hr Heine 400 lbs. steam, 620 deg. T. T. oil burner
30,000 lbs/hr B&W 525 lbs. steam, 600 deg. T. T., pulverizer

DIESEL UNITS

3 phase 60 cycle

1250 KVA General Motors 2400 v.
575 KVA McIntosh-Sey. 2400 v.
432 KVA Worthington 2400 v.
365 KVA Worthington 2400 v.
325 KVA Fairbanks-Morse 2400 v.
250 KVA Fairbanks-Morse 2400 v.
213 KVA Fairbanks-Morse 2400 v.
187 KVA Fairbanks-Morse 2400 v.

MOTOR GENERATOR SETS

3 phase 60 cycle

500 KW Wstgh. 750/1500 v D.C., 2300 v. A.C.
300 KW G.E. 250 v D.C., 2300 v A.C.
200 KW G.E. 250 v D.C., 440 v A.C.
200 KW C. W. 125 v D.C., 2300 v A.C.
150 KW Reliance 250 v D.C., 4150 v A.C.
60 KW G.E. 125 v D.C., 440 v A.C.

ROTARY CONVERTERS

3 phase 60 cycle

3500 KW G.E. 225/285 v D.C., 13,800 v A.C.
2000 KW Allis 600 v D.C., 4150 v A.C.
1500 KW Wstgh. 600 v D.C., 4000 v A.C.
1000 KW G.E. 600 v D.C., 13200/22000 v A.C.

RECTIFIERS

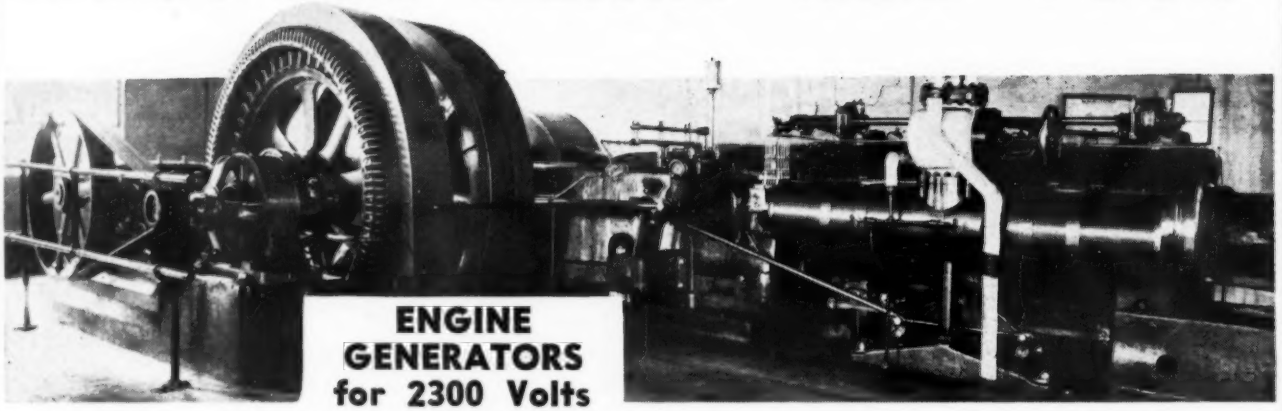
3 phase 60 cycle

3000 KW G.E. 600 v D.C., 13800 v A.C.
900 KW Brown Boveri 600 v D.C., 2300/13800 v A.C.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone Main 9514** **CLEVELAND 14, OHIO**

1200 KW PLANT-NEW 1933



ENGINE GENERATORS for 2300 Volts

Two Skinner Uniflow Units, 600 kw each — Two B & W Stirlings, 502 HP, 200#

ALL AUXILIARIES — EXCELLENT CONDITION

Also 500 KW 250 V. DC Hooven Owens Rentschler, built 1920

TURBO GENERATORS

EXTRACTION CONDENSING

2500 KW 480 V. 3 ph 60 cycle—175/185# ISP 525° F. TT Extraction 58000 #/hr max. at 5# g (1920) Turbine being rebuilt. Will arrange for extraction at 30# g. if required. All auxiliaries.

2000 KW 550 V. 3 ph. 60 cycle—225# ISP 500° F. TT General Electric. Ingersoll Rand surface condenser. Rebuilt in 1932 for 20# g. extraction.

CONDENSING

1000 KW 600 V. 200# 100° SH. Surf Cond. (A.C. 1920)
1250 KW 2400 V. 200# 100° Surf. Cond. (Approx. 1924)
1500 KW 480 V. 200# SH. Surf. Cond. (1923)
600 KW 60/3/240 V. 150# ISP 20.5# W. R. Surf. Cond. Complete (G. E. Serial #20000)

NON-CONDENSING

1500 KW Allis 2300 V. 175# 10# max. BP. Rebuilt for war operation. Not used.

2000 KW G. E. 480 V. 175# 10# BP. Can be renozzled for 225# 500° TT. Good for 20# without change.
1000 KW Allis 2400 V. 200# 5/10# BP (1920)
100 KW 480 V. 200# ISP 20# BP G. E. (1921)

DIRECT CURRENT

1000 KW 250 V. DC 150# Surf. Cond.
750 KW 250 V. 16#/165# (MP) Jet Cond.
150 KW (2 units 250 V. 225# 25# g. BP Modern Design NC Unit.

BOILERS - MODERN STEAM GENERATING UNITS

Now ready for dismantling—30 day shipment 90,000# hr. C. E. Co. type VU, 550/600#, 750° F. TT; pulverized fired, built 1940; report excellent condition

350—400—450 PSIG.

3—25,000# hr. 400# 650°—waterwalls—built 1928.
1—30,000# hr. B&W 425# Integral Furnace Type. Pulverized Coal Fired.
1—40,000# hr. 350# 100° SH Combustion Eng. Integral Furnace with Type E Stoker.

MID PRESSURE UNITS

600 HP 160# Sectional Header. Four of these—Pennsylvania and Indiana.
519 HP Heine Type Design. Now approved 180#. Can ship intact most Midwest points. Not necessary to remove or replace tubes. Coxe Chain Grate Stoker.
650 HP 200# 100° SH Box Header (1932). Tubes good. Dismantled. Ready to ship.
2—60,000#/hr. Erie City 225#, pulverizers, about 6 years old.
2—New C. E. boilers, 25,000#/hr., 275 PSI.

POWER TRANSFORMERS

1—10,000 KVA Pittsburgh. 13,200 V. Primary to 4600 V. 60 cycle, 3 phase, Delta Connected. Complete. Cannot reconnect other Elspecs.
—5000/6667 KVA G. E. Type OAPT. OISC. Primary 24,000 Delta; four 2½% taps below. Secondary 230/460. Practically new.
2—1500 KVA 3 phase, 33,000 primary, 2400 secondary, outdoor—rebuilt.

PAUL STEWART & CO., INC.

UNION TRUST BUILDING — **CINCINNATI 2, OHIO**

Over 50 Years of Service

Motors

. . . always a wide selection . . . always unusual values

Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 200/440 Volt

(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	250	G.E.	KF Vert.	3600
1	150	Al. Ch.		1750
1	150	G.E.	I-17 550 Volt	400
1	150	West.	CS	345
2	125	Cr. Wh.	126Q	430
1	120	G.E.	FT	3600
1	100	Howell	SCBB	1800
1	100	G.E.	I-17A	290
2	50	R.&M.	L	1200
1	50	Al. Ch.	AN	900
1	50	G.E.	I 2200 Volt	900
1	50	F. M.		900
1	50	G.E.	I	720
1	50	West.	MS 25 Cycle	720
1	50	Wagner	BM	495
1	50	Al. Ch.		490
1	40	Al. Ch.	2200 Volt	1200
2	35	Al. Ch.	2 Phase	900
1	35	Al. Ch.		900
1	35	G.E.	I 25 Cycle	730
1	30/20	West.	CS TEFCBB	1800/900
1	30	F. M.	QZC TEFCBBEP	1200
1	30	Cr. Wh.		900
2	30	Al. Ch.	AN 2 Phase	900
1	30	Century	AS	720
1	25	Howell		1200
1	25	F. M.	QZK B. B. New	1200
1	25	Wagner	BP	1200
1	25	Burke	EM3	900
1	25	Lincoln		900
1	25	Al. Ch.	AN	720
1	25	G.E.	M10	720
1	25	West.	MS 25 Cycle	600
2	20	U. S.	SC SPBB	1800
2	20	F. M.	QZK B. V. New	1800
1	20	West.	CS	1800
1	20	Howell	N Vert. B.B. New	1200
1	20	F. M.	KRV	1200
1	20	Cr. Wh.		900
1	20	G.E.	I-K 2200 Volt	900
1	20	Cleve.	M	900
1	20	Al. Ch.		900
1	20	West.	MS 25 Cycle	900
1	18	West.	MS (Elev.)	720
1	15	F. M.	HLS	3600
4	15	F. M.	QZK B. B. New	1800
2	15	West.	MS 25 Cycle	715
1	10	Al. Ch.		1800
1	10	Imperial	EH B. B.	1200
1	10	West.	CS 25 Cycle	725
5	7½	G.E.	KT	1800
1	7½	West.	CS	1800
3	7½	Wagner	11VRW	1800
3	7½	G.E.	KT	1200
20	3	Imperial	E (New)	1200

Approx. 200 New motors from 2 HP—30 HP.

SLIP RING & SYNCHRONOUS

3 Phase, 60 Cycle, 220 or 440 Volt

(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	443	El. M.	Syn.	900
1	300	G.E.	ATI Syn.	1800
1	200	F. M.	BV	600
1	100KW	G.E.	ATB Syn.	900
1	100	G.E.	I-16 2200 Volt	450
1	75	F. M.	BV 2200 Volt	1800
1	75	West.	(New) Syn.	1200
1	60	Ideal	AVX	1200
1	50	G.E.	I 25 Cycle	700
1	50	Al. Ch.		720
1	50	Ideal	AV 2200 Volt	600
1	40	G.E.	MT	1200
1	40	Al. Ch.		1200
1	40	G.E.	MT	900
2	40	West.	CW 2200 Volt	900
2	40	West.	CW	900
2	40	Al. Ch.		900
1	40	West.	CI	730
1	40	Burke	EMV7	1150/550
1	35	Al. Ch.		720
1	35	G.E.	I-12	600
1	30	Al. Ch.	2200 Volt	720
1	25	Cr. Wh.		1200
1	25	West.	CW	720
1	25	West.	MW	720
1	25	G.E.	MT Tot. Encl.	600
1	25	G.E.	MT	400

DC—230 Volt

Qu	HP	Make	Type	Speed
1	130	Cr. Wh.	CMC 550 Volt	1200
1	100	G.E.	CD	1200
1	100	West.	SK	1800
1	100	G.E.	RC38	600
1	100	G.E.	PCS 440 Volt	400
4	100	Cr. Wh.	CMC	225/550
4	85 KW	West.	SK Dynamometer	1200/2200
1	75	Diehl	K11	700
1	60	West.	SK 115 Volt (Vert.)	1200
1	60	G.E.	EF1	1200
3	50	West.	SK	1200
1	40	Rel.	440 Volt B. B. Vert.	1800
1	40	Rel.	440 Volt B. B. (Vert.	1200/1800
1	25/40	Cr. Wh.	CMC 440 Volt (Vert.	1200/1800
1	40	Rel.	B. B.	400/1500
2	40	West.	SK	1200
1	40	G.E.	RC	1200
7	40	West.		775
1	35	G.E.	OMTEBB	1300
1	35	West.	SK	1200
1	35	Al. Ch.		1200
1	35	G.E.	DLC	700
2	30	El. Dy.	15S	625/1250
5	30	Rel.	92TF	1800
1	30	Rel.	131T 440 Volt (Vert.)	1200
1	30	G.E.	RC	1200
1	30 KW	Al. Ch.	110 Volt	925
1	27½	G.E.	CVC116	1800
1	25	Cr. Wh.	CM 110 Volt	900/1200
1	25	Al. Ch.	E120	500/1500
1	25	Rel.	25P	250/1000
1	25	G.E.	RF	300/900
1	25	F. M.	1RC	400/800
6	25	West.	SK	1200
7	25	West.	SK	850
2	20	Rel.	131T	1000/2000
2	20	West.	SK	750/1500
1	20	Diehl	K9	500/1000
1	20	G.E.	CD	400/1600
1	20	G.E.	RF	250/1000
1	20	Lincoln	FKW B. B.	1800
6	20	Cr. Wh.	CMC Enclosed	1800

DC—230 Volt

Qu	HP	Make	Type	Speed
1	20	Cr. Wh.	CMC TEBB (Exp.)	1200
1	20	Rel.	92T	1200
2	20	West.	SK	1200
1	20	West.	SK	900
1	20	G.E.	RC	900
7	20	West.	SK	750
1	20	West.	SK	500
1	15	West.	SK63	1800
1	15	West.	SK113 Encl.	1800
1	15	F. M.	D B. B.	1150
6	15	Rel.	66T	1150
2	15	Cr. Wh.	CCM	1150
1	15	Cr. Wh.	CCM Tot. Encl.	1500
1	15	West.	SK83	1150
2	15	West.	SK80L	1150
1	15	G.E.	CD	1150
1	15	West.	SK90	850
1	15	West.	K9 Crane	630
8	15	Rel.	92TF	850/1700
2	15	G.E.	CO Crane	650/2700
1	15	Rel.	131T 115 V.	600/1500
2	15	West.	SK	600/1200
1	15	Rel.	78T	400/1600
1	15	G.E.	RF11	400/1200
1	12½	West.	SK	750/1500
1	12	G.E.	RF	575/1725
1	10	West.	SK7	850/1700
2	10	G.E.	RF10	600/1800
1	10	West.	SK90	600/1800
7	10	West.	SK80L	500/1500
20	10	Al. Ch.		500/1000
1	10	Rel.	92TF	400/1600
1	10	West.	SK	240/1000
1	10	Cr. Wh.	CM TEBB	1800
1	10	Century	R304	1800
15	10	West.	SK	1150
2	10	West.	SK 115 Volt	1150
3	10	Rel.	46TF	1150
1	10	G.E.	RC9	1150
2	10	Rel.	66TF	850
2	10	G.E.	RC	850
3	10	West.	SK70	850
1	10	G.E.	RC29 550 Volt	850
1	10	Colonial		960
14	7½	West.	SK33	1750
4	7½	West.	SK60	850
20	5	West. & Gen. Elec.		1750
20	5	West. & Reliance		1150
35	5	West.	SK43	850

Hundreds of other DC motors not listed

28 New vertical, T.E.F.C.B.B., 3 Ph, 60 Cy, 220/440 volt as follows:
1—Fairbanks-Morse, 3 HP, ty. QZCU, Fr. 254, 1200 RPM Exp.
2—General Electric 3 HP, ty. K, Fr. 254, 1200 RPM
8—General Electric 7½ HP, ty. K, Fr. 324, 1200 RPM
8—Delco, 7½ HP, type C, Fr. 324, 1200 RPM
1—Howell, 7½ HP, type KV, Fr. 284, 1800 RPM
6—General Electric, 15 HP, type K, Fr. 365, 1200 RPM
2—Howell, 15 HP, type KV, Fr. 365, 1200 RPM

1—New General Electric 250 HP, type KF, Frame 549A, 440 volt, 3 phase, 60 cycle, 3600 RPM vert., direct connected to Bingham type 2, 22 stage, double case, 3600 RPM, 3820 head, 175 GPM

3—New Allis Chalmers 200 HP, type ARZ, 2300 Volt, 3 phase, 60 cycle, 3600 RPM, totally enclosed, fan cooled, ball bearing

1—150 KW Westinghouse synchronous M-G set, 275 volt DC, 4400 volt AC, 3 phase, 60 cycle, 900 RPM, AC control & DC panel
1—150 KW General Electric M-G set 250/275 volt DC, 440 vol AC, 3 phase, 60 cycle, 900 RPM
1—100 KW Ridgeway synchronous M-G set, 250 volt DC, 2300 volt AC, 3 phase, 60 cycle, 1200 RPM AC control & DC panel
1—200 KW Burke synchronous M-G set, 250 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel
1—30 KW Westinghouse M-G set, 125 volt DC, 2300 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel

6—Practically new 40 KW Reliance & General Electric variable voltage M-G sets, 250 volt DC, 220/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters, all control and drive motors. All motors ball bearing, enclosed. M-G set, exciters and control mounted in fan cooled enclosure. Drive motor G. E. type CD, frame 1441, 40 HP, 230 volt 400/1600 RPM, enclosed, ball bearing, 50° Cont. 250 RPM, 1 hr. 50°

The Wente Electric Co.

Rebuilt Motors and Generators Since 1906

Hamilton — PHONE HAMILTON 707 — Ohio

POWER EQUIPMENT BARGAINS

NEW SURFACE CONDENSERS

3—Surface Condensers 9500 sq. ft.
2—Surface Condensers 7900 sq. ft.
2—Surface Condensers 8200 sq. ft.
1—Surface Condenser 6300 sq. ft.
3—Surface Condensers 3300 sq. ft.
4—Surface Condensers 2200 sq. ft.
2—Surface Condensers 1500 sq. ft.
8—Surface Condensers 600 sq. ft.

HEATERS

5—Deaerating Feed Water Heaters, capacities 40,000 to 90,000# per hour. NEW.

STEAM TURBINES

1—5000 KVA 3 Ph. 60 Cycle 2300 Volt 440# late model G. E. Bleeder Type Turbine with auxiliaries.
2—750 KW G. E. 480 Volt Condensing Turbines.
1—200 KW Slightly Used 3 Ph. 60 Cycle 440 V. G. E. Condensing Turbine, 400# Pressure.
1—800 HP Westinghouse 4883 RPM, 535# PSI, 2 bearing.

TURBINES

1—275 HP G. E. Curtis Horizontal Turbine, 3600 RPM, 120# Pressure Condensing.
8—115 HP G. E. Horizontal Turbines, 4000 RPM, 435# Pressure, 10# B. P. NEW.
2—19 HP Terry, 18" Wheel, 1860 RPM, 235# Pressure, 10# B. P. NEW.

AIR EJECTORS — NEW

5—Air Ejectors, New Twin, 2-Stage, for 8000 KW Turbine.
6—Air Ejectors, Twin, 2-Stage, New with inter and after Condensers for 6000 KW Turbines.
3—Air Ejectors, Twin, 2 Stage, New. With inter and after Condensers, for 500 KW Turbines.
3—Air Ejectors, Twin, 2-Stage, New with inter and after Condensers, for 4000 KW Turbines.

EVAPORATORS—NEW

4—80,000# fresh or 40,000# salt water per 24 hr. day capacity Renauld Evaporators. Manifold cast bronze. Coiler SD copper tubing. NEW.
5—Paracoil-Davis, 90" high x 56" dia.

BLOWERS—NEW

2—82,000 CFM forced draft blowers driven by 253 HP steam turbines.
5—19,000 CFM at 10.8" Buffalo forced draft blowers, Type SL, Size 6-82 with control vanes. Direct connected to 50 HP, 3 ph. 60 cycle, 440 volt motor, variable speeds and capacities. (4 clockwise and 1 counter-clock)
2—15,930 CFM forced draft blowers driven by 30 HP motors.
3—5500 CFM forced draft blowers, steam turbine driven.

CIRCULATING PUMPS—NEW

3—3000 GPM Dayton-Dowd, vertical, centrifugal, split case, circulating pumps, 24.5' head Direct connected to 25 HP 230 V, DC, 656/875 RPM ball bearing motors.
2—Circulating Pumps, 13,000 GPM.
6—Circulating Pumps, Main, 10,500 GPM.

BOILER FEED PUMPS

8—470 GPM, De Laval, horizontal, centrifugal, 750 PSI discharge head, 5140 RPM. Powered by 320 HP, De Laval steam turbines, 2-stage 575# max. steam pressure.
3—200 GPM, Pacific, Size 2"S, horizontal, split case, 4 stage, centrifugal, 1380' head, 4" suction, 2" discharge, 4000 RPM. Direct connected to 115 HP, 4000 RPM, G. E. turbine, 435 PSI steam pressure, NEW.
9—200 GPM, Ingersoll Rand, 6-Stage, horizontal, 600# pressure, 1465' dynamic head, bronze impeller, 2½" suction, 1½" discharge. Direct connected to 125 HP, steam turbine, 150# pressure, 4125 RPM.
2—150 GPM, Pacific pumps, horizontal, centrifugal multi-stage, split case, 525# press., 1282' head, bronze impellers, 2" suction, 4" discharge. Direct connected to 110 HP, Westinghouse turbines, 4050 RPM, 440# max. steam pressure.
4—157 GPM, 12 x 8 x 24 Worthington, vertical, simplex steam pumps, 600# discharge pressure, 300# max. steam pressure, bronze fitted, 5" suction, 4" discharge.

CONDENSATE PUMPS—NEW

24—14 GPM, Goulds, horizontal, single stage 143' head, bronze impellers, 1½" suction, 1" discharge, close coupled to 2 HP, 230 volts, 3500 RPM. Reliance DC motors with magnetic push button marine type controllers.

POWER PUMPS

1—Gardner Denver, horizontal duplex power pump, max. working pressure 1600#, max. speed 65., 4" suction, 3" discharge. NEW.
4—1-3/16 x 1-11/16, Deming, horizontal duplex, double acting, 10 GPM, suction lift 12', max. discharge pressure 120#, suction 1½", discharge 1". V-Belt driven by ¾ HP Peerless 230 Volt, 1750 RPM, Cpd. wound motors.

SIMPLEX STEAM PUMPS—NEW

5—14" x 11" x 18" Worthington vertical simplex steam pumps. 400 GPM, 125# discharge pressure, 140# max. steam pressure, 10# suction, 8" discharge.
2—12" x 14" x 18" Worthington vertical simplex steam pumps. 600 GPM, 50# discharge pressure, 140# max. steam pressure, 10# suction, 8" discharge.

DUPLEX STEAM PUMPS—NEW

13—7½" x 9" x 12" Worthington design vertical duplex steam pumps, 325 GPM, 230# steam pressure, 15# back pressure, 6" suction, 5" discharge.

FUEL AND LUBE OIL PUMPS—NEW

3—10" x 11" x 18" Worthington vertical simplex lube oil pumps, 325 GPM, 50# discharge pressure, 6" suction and discharge, 140# max. steam pressure.
5—225/325 GPM, De Laval, IMO, lube oil service pumps, 43# pressure, vertical. Direct connected to 15 HP 230 Volt, 950/1750 RPM Reliance DC ball bearing motors. NEW.
4—22 GPM, Kinney "Heliquad" horizontal rotary fuel oil pumps, Size 42-181, 325' head 20' suction lift. Direct connected 10 HP, 230 V G. E. DC motors through 4.15:1 reduction gear with speed regulating rheostat controllers.

FEED WATER REGULATORS—NEW

8—Hammel-Dahl Feed Water Regulators, remote control of liquid level for feed water heaters.

STEAM TURBO-GENERATORS, A. C.

6—312 KVA, Westinghouse, 1200 RPM (thru gears) 3 ph. 60 cyc. 440 V, 440# Pressure, NEW.
2—100 KW General Electric, 125 KVA, 4 wire, 3 Ph. 60 cyc. 240/110 V, 3600 RPM. Turbine 150/200 PSI.

STEAM TURBO-GENERATORS, D. C.

6—300 KW Westinghouse, 3 wire, 120/240 V, 1200 RPM, Turbine Condensing, 400 PSI, geared, NEW.
1—290 KW Westinghouse 120/240 V, 1200 RPM Geared to turbine, 200# pressure, 4410 RPM, NEW.
1—50 KW Sturtevant, 125 V, 2800 RPM Turbine 150# Pressure.
1—35 KW G. E. 115 V. 3400 RPM Turbine 125# Pressure.
2—25 KW, Westinghouse, 125 V, geared to 7260 RPM. Turbine, 200# pressure.

STEAM ENGINE DRIVEN UNITS

3—20 KW Marine Electric Co. Generators; 120 V, 500 RPM, compound wound, powered by Gault vertical steam engine. NEW.

BOILERS—NEW

2—1500 HP 3 Drum B&W 300#, with superheaters, new and unerected. 150,000# Steam, with oil burners, casing, erection steel, soot blowers and safety valves. Built in 1943. Fine self-contained units.
3—1000 HP Combustion Engineering Co. 105,000# Steam, 300# pressure, with steel and casing, soot blowers, oil burners and safety valves.
10—600 HP, 440# Combustion Engineering Co. 49,000# Steam, superheaters, oil burners and trim.
2—500 HP, Combustion Engineering Co. Cross Drum, Sectional header, 440#, 750° T. T., oil burning.

D. C. GENERATORS & M. G. SETS

6—300 KW NEW Westinghouse DC 240 Volts 1200 RPM, 3 wire Generators. Can also offer same with 321 KVA 3 ph. 60 cyc. 440 Volt NEW Westinghouse Synchronous MOTORS.

CIRCUIT BREAKERS

10—2000 amp. 500 Volt AC 3 pole latest type G. E. Circuit Breakers. NEW.
2—5000 amp 500 Volt AC 3 pole G. E. solenoid operated Oil Circuit Breakers.

MOTORS—DC—NEW

6—765 HP G. E. 2 Bearing 500 Volt DC 1030/1300 RPM.

STEAM DIESEL AND GAS ELECTRIC POWER UNITS

DIESEL ENGINES

2—950 HP Cooper-Bessemer, 300 RPM, 8 cylinder, 4 cyc. solid injection. UNUSED.
3—448 HP Baldwin, 4 cyc. 400 RPM. UNUSED.

DIESEL ELECTRIC POWER UNITS

3—290 KW, 240 V, Direct current, Generators, shunt wound, 1200 RPM (2 Westinghouse, 1 General Electric)
Direct connected to 500 BHP Gen. Motors, 8-cylinder Diesels, Model 8-268A.
If AC Generators required, we have available: 1 NEW, 2 Slightly used.
3—250 KW, 315 KVA, .80 PF, 1200 RPM Alternators 3 Ph. 60 Cyc. 450 V., 400 A. with 5.5 KW 1200 RPM shunt wound direct mounted Exciters. NEW. With used General Motors Diesels.
6—30 KW 3 Ph. Diesel Driven Power Units, Buda, NEW.

GAS ELECTRIC LIGHTING UNITS, AC

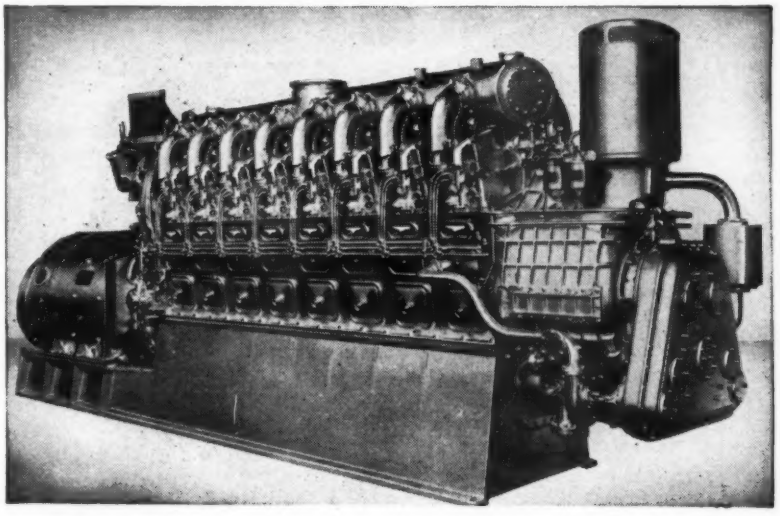
16—15 KW, 18.75 KVA Kato Generators, 3 ph. 60 cyc. 4 wire, 127/220 Volts, 1800 RPM, direct connected to Chrysler 6-cylinder engines. NEW.
24—10 KW, O'Keefe & Merritt Power Units, Single phase, 60 cyc., 120/240 Volt, 4 wire, 1800 RPM with 4-cylinder gas engine. NEW.
16—7.2 KVA, 5 KW, .7 PF Onan, 110 V, single phase, 60 cycle. NEW.

Subject Prior Sale

SUNDFELT EQUIPMENT COMPANY, INC.

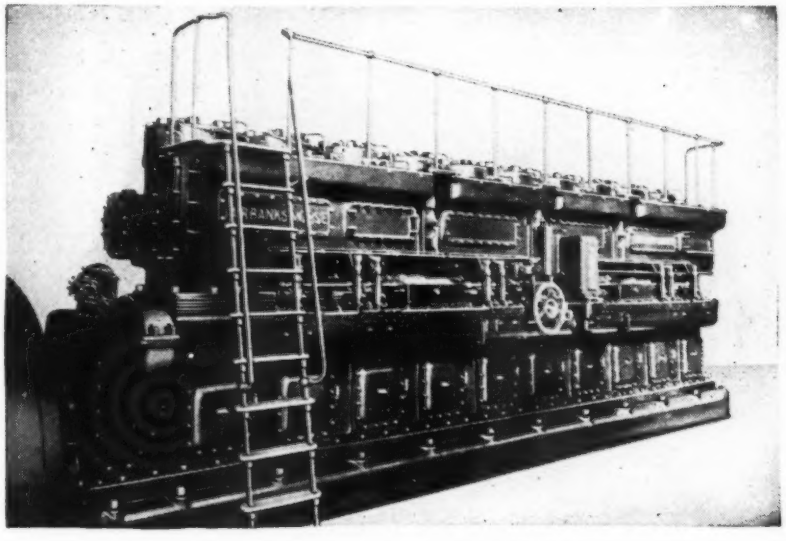
3422 First Avenue South **MAin 1474** **Seattle 4, Washington**

Important Diesel Offerings!



1000 KW G. M. DIESELS

1600 HP General Motors Model 16-278A Engines 16 Cylinder—2 Cycle— 720-750 RPM Direct Connected to 50-60 Cycle AC or 525 Volt DC Generators



2-2000 HP FAIRBANKS MORSE

Latest Model 33 Diesels, 10 cylinders —2 cycle, 16 x 20—300 rpm pump scavenging type, with oil cooled pistons.

COMPLETE GENERATOR PLANTS
1875 KVA

Diesel Generators

HP	MODEL	KVA	RPM	NEW	HP	MODEL	KVA	RPM	NEW
1—840	Fairbanks Morse M	565	257	99%	3—165	Murphy ME 650]	145	1200	95%
2—450	Fairbanks Morse 33E	375	360	95%	2—150	Buckeye Model E	145	400	95%
1—450	Buckeye Model 80	360	600	New	5—100	International UD18	62.5	1200	New
1—375	McIntosh Seymour	350	360	85%	1—100	General Motors 6-71	75	1200	Unused
1—365	Ingersoil Rand S	340	600	95%	1—90	Cummins HIS 600	62.5	1200	New
4—360	Fairbanks Morse YVA	300	257	80%	1—80	Fairbanks Morse YVA	65	300	85%
1—300	Buckeye Model E	250	400	90%	1—75	Buckeye Model J	62.5	600	95%
2—240	Fairbanks Morse YVA	200	257	85%	4—65	International UD14	37.5	1200	New
10—225	Buckeye Model 80	180	600	New	1—60	Buckeye Model J	50	600	95%
1—180	Fairbanks Morse YVA	150	257	95%	1—40	Buckeye Model J	30	600	95%

Diesel Motors

WE HELP TO LIGHT AND POWER THE WORLD

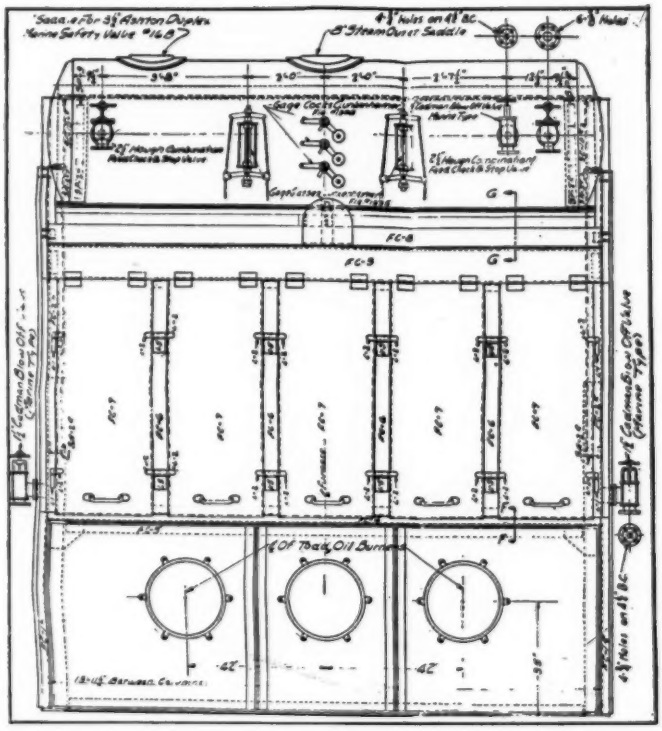
PORT WASHINGTON, L. I., N. Y. **CORPORATION** **TEL: PORT WASHINGTON 2000**

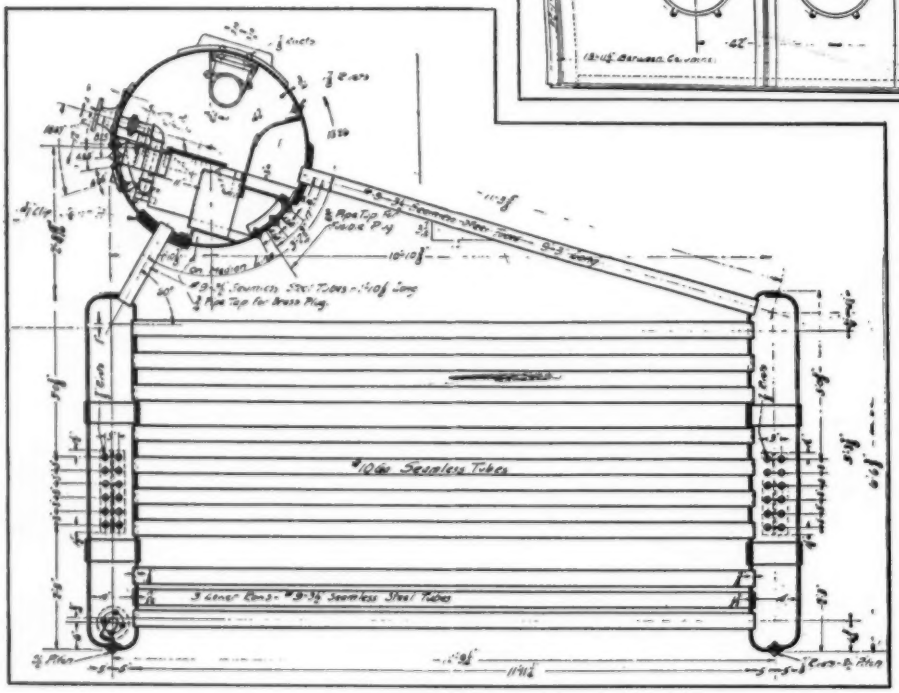
POWER PLANT SPECIALISTS

OFFERING FOR IMMEDIATE DELIVERY

SIX

400/500 HP Steel encased water tube boilers — cross drum type — 225 lbs. pressure Rebuilt and retubed 1943.





Each boiler contains 309—3½" straight tubes connected to a 42" x 14' steam cross drum and fired with 3 Todd Oil Burners — complete with all trim.

HOWE BROTHERS

342 MADISON AVENUE, NEW YORK 17, N. Y.

Tele. Nos. Mur. 2-8562-8563-8564

GLOW

SPECIAL—NEW PLATING GENERATORS

200 Amp., 10 to 15 volt, 1725 RPM, direct current, Master Plating Generators with overhung exciter.

TRANSFORMERS

General Electric Spirakore Transformers, 167 KVA, 2400/4160Y volt primary, 120/240 or 240/480 volt, secondary, 1 phase, 60 cycle, oil cooled, outdoor type.

COPPER OXIDE PLATING RECTIFIERS

500 Amp., 6 volts, Direct Current, for 440 volt, 3 phase, 60 cycle power, General Electric, Model 6RC120F2.

Note: Designed to be operated in series or parallel for higher voltage or current.

A. C. GENERATORS

(3 phase unless otherwise noted)

KW	P.F.	RPM	Volts	Description
3	1	1900	120	Hobart, Ball Bearing
4	1	1170	440	Westinghouse, Single Phase
7½	.6	1800	440	Electric Specialty, Ball Bearing
15	1	1800	127/220	General Electric, Single Bearing
20	.8	1800	1100	Fairbanks-Morse
20	1	1000	110	Ft. Wayne, Single Phase
25	.8	1200	208/120	Westinghouse, Ball Bearing, New
30	.8	1200	120/208	Delco
40	8	1200	220	Burke, Single Bearing
50	.8	1200	120/208	Electric Machinery, Single Bearing, 4 Wire
37½	.8	900	110/220	Starr, Single Phase
100	.8	900	200	Crocker-Wheeler
100	1	900	2300	General Electric
120	.8	257	2300	General Electric, Single Bearing
150	1	600	480	Burke
150	.8	900	600	General Electric
150	.8	600	480	Crocker-Wheele

PLATING GENERATORS

Jantz & Leist, type IP, 4000 ampere, 2 to 12 volts, 425 RPM, direct current Plating Generators with or without driving motors.

GAS ENGINE—AC GENERATOR SETS

2½ KW Leland, type A, frame 50, 1800 RPM, 120 volt, single phase, 60 cycle, AC Generator, with Briggs & Stratton, Model ZZ, 6 HP, 1800 RPM Gasoline Engine, U. S. Army PE75AA, complete with gas tank and tool box.

5 KVA Onan, .8 P.F., 1800 RPM, 110/220 volt, single phase, 60 cycle, AC Generator with Onan, twin, 4 cylinder Gasoline Engine complete with starting panel.

7½ KVA, 120 volt, 3 phase, 60 cycle, AC Generator with 4 cylinder Wisconsin Engine, U. S. Army PE99, type VE4-1, size 3 x 3¼, complete with switchboard panel.

10 KVA, 110/220 volt, single phase, 3 wire, 60 cycle, Westinghouse, AC Generator with water cooled Jeep Engine Drive, U. S. Army PE95, 4 cylinder. Complete with switchboard panel.

25 KVA Westinghouse, 20 KW, .8 P.F., 900 RPM, 120 volt, 1 phase, 60 cycle, AC Generator, with LeRoy Gas Engine complete with control panel.

31.25 KVA, 25 KW Westinghouse, .8 P.F., 1200 RPM, 208/120 volts, 3 phase, 60 cycle, AC Generator with LeRoy Gas Engine complete with control panel.

Note: In addition to the above Engine Generator Sets, our stock includes practically all sizes up to 35 KVA both AC and DC, some with Diesel Engine Drive.

NEW DIRECT CURRENT MOTORS

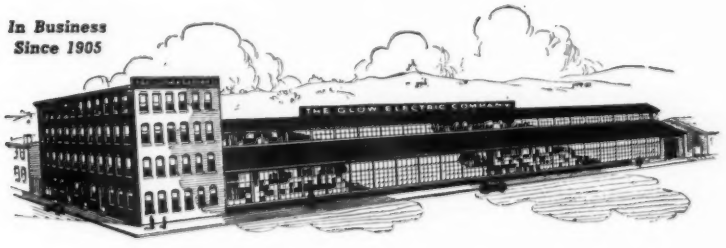
25 HP, 1750 RPM, 230 volt, compound wound, Marble-Card motors, Marine type, drip proof.

MOTOR GENERATOR SETS

KW	Volts	Generator Mfgr	A. C. Motor
*600	250	General Electric	900 HP, 1200 RPM, General Electric, Synchronous
*300	250	General Electric	450 HP, 1200 RPM, General Electric, Synchronous
200	125	General Electric	300 HP, 900 RPM, General Electric, Synchronous
50	120/125	Burke	95 HP, 1200 RPM, Burke Synchronous
*50	115/230	Westinghouse	75 HP, 1800 RPM, Westinghouse, Induction
40	250	Reliance	60 HP, 1800 RPM, Century, Induction
25	125	General Electric	35 HP, 1200 RPM, General Electric, Induction

* These Motor Generator Sets are unused.

In Business Since 1905



Late Type TURBO-GENERATOR SET

Westinghouse 300 KW, 1200 RPM, 120/240 volt, compound wound, D.C. Generator with interpoles, directly connected to:

Joshua Hendy Steam Turbine, 5965 RPM, for steam conditions of 440 lbs. per sq. inch gauge inlet pressure 28½" vacuum, 740 deg. F. total temperature. Including speed reducer, rheostat and balancer coil.

DYNAMOMETERS

General Electric, 50 HP, 700/2500 RPM, 250 volt, 21.008 inch torque arm. Can absorb up to 60 HP motor.

DIRECT CURRENT GENERATORS

KW	Volts	RPM	Manufacturer	Description
400	120/240	300	Westinghouse	Compound, Interpole, Pedestal Bearing
290	250	900	General Electric	Single Bearing
250	120/240	1200	Crocker-Wheeler	Compound Wound
200	125	900	General Electric	Compound Wound
200	250	1200	General Electric	Single Bearing, Compound Wound
200	250	375	Jantz & Leist	Compound Wound, Pedestal Bearings
175	250	450	Westinghouse	Compound Wound, Pedestal Bearings
150	250	900	General Electric	Single Bearing
100	240/325	1200	Elliott	Single Bearing
100	125	1200	Western Electric	Compound Wound
100	125	900	Crocker-Wheeler	Compound Wound, Pedestal bearings
80	125	500	Jantz & Leist	Compound Wound, Double Shaft Extension
80	125	400	Jantz & Leist	Compound Wound, Double Shaft Extension
30	250	300	Triumph	Compound Wound
22½	250	765	Westinghouse	Compound Wound

ELECTRIC CO.

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC HOISTS
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

933-943 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

LIQUIDATION SALE

(MOST EQUIPMENT 3 TO 4 YEARS OLD)

DIESEL ENGINES

2—300 HP Fairbanks Morse Model 38 O.P. 6 cyl. 2 cycle 5"x6" 1200 RPM (built 1936)

2—350 H.P. Superior Diesel Ser. #10501 & 10529, Type VD, ME, 8 cyl., Bore 9", Stroke 12", 600 R.P.M., built 1939

4—1800 H.P. General Motors 16-258S, 16 cylinder, 9½" x 12", 4 cycle, Buchi supercharged 900-750 RPM (new 1943)

2—1800 H.P. (HOR) Hamilton 9 cylinder, 2 cycle, 800 RPM, reversible (new 1944)

2—500 H.P. General Motors 8-268A, 8 cyl., 6½" x 7", 2 cycle, 1200 RPM (new 1943)

The above engines can also be supplied with fluid couplings, reduction gears and all other equipment suitable for ship installation.

DIESEL GENERATORS

7—1200 KW, D.C., Allis Chalmers, 525 V. 750 RPM Driven 1700 HP General Motors Diesel 16-278A 750 RPM (New 1943)

3—200 KW, AC, 3/60/440 and 40 KW, DC, 120/240 V Driven by 500 HP General Motors Diesel, 8-268A, 8 cyl., 6½ x 7" 2 cycle, 1200 RPM (new 1943)

1—100 KW AC 3/60/440 and 2 KW DC 120 volts driven by 150 HP General Motors Diesel, 3-268A, 3 cyl., 1200 RPM (new 1943)

2—60 KW., DC, 120 V driven by 90 H.P. General Motors Diesel 6-71, 6 cylinder, 4½' x 5" 1260 RPM. New 1943

1—60 KW, DC, Generator, 250 V. driven by 110 H.P. Buda Diesel, 8 cylinder, 4 cycle. New 1944

All auxiliary equipment can be furnished

MOTORS

5—DC 25 HP, 35 HP, 50 HP, type CO 1808, 230 V, all variable speed 550 RPM to 2100 RPM

500—DC, from ½ HP to 80 HP, 120 V, various speeds

18—General Electric AC synchr. motors, 3 phase, 6000 HP, 93 1-3 cycle, 2700 V, 400 RPM, or 3800 HP, 60 cycle 1700 V, 257 RPM

28—DC 1500 HP W'hse, 525 V, 600 RPM

HOISTS

2—Mead Morrison Co., 2 drum hoisting engines type H197, driven by 51 HP G.E. motor 230 V, DC

TURBO-GENERATORS

1—4600 KW G.E. 3 phase, 93 1-3 cycle, 2700 V, 5600 RPM (or 2900 KW, 60 cycle, 1700 V, at 3600 RPM), 410# cond., complete with 3800 sq. ft. condensers, amplidyne motor generators, circulating and condensate pumps, etc.

6—300 KW G.E. type ATI 3/60/450, 1200 RPM, cond., compl. with 40 KW exciters, condensers, switchboards.

1—500 KW 3/60/480, 3600 RPM, 185# press. cond.

8—200 KW, G.E. type ATB 3/60/450, 1200 RPM, cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—375 KW West'hse 180/220 V, DC, 3000 Amp, 1200 RPM, cond.

1—300 KW 120/240 V, D.C. 1200 RPM

12—150 KW West'hse type SK, 120 V. DC, 1200 RPM, cond.

20—60 KW West'hse type SK, 120 V. DC, 1800 RPM, cond.

NOTE—MANY GENERATORS FOR SALE SEPARATELY WITHOUT TURBINES

MOTOR-GENERATORS

AC to DC and DC to AC—various sizes from 1 HP to 80 HP.

GENERATORS

28—1200 KW DC Allis Chalmers, 525 V, 750 RPM

TURBO-BLOWERS

3—Sturtevant size 24—20,000 CFM at 17" S.P. turbine, 191 HP, 400# steam

CONDENSERS

4—7800 Square Feet—¾" brass tubes, two pas. (new).

10—3800 Square Feet ⅝" copper-nickel tubes (new).

SWITCHBOARDS

All sizes, AC and DC, whole or in parts, circuit breakers, current transformers, switches, meters, recorders, etc, etc.

TRANSFORMERS

5—50 KVA		from 440 V to 120 V, all single phase, 60 cycle, dry type
10—20 KVA		
10—25 KVA	5—8KVA	

BOILERS

2—Boilers, single pass., header-type, Babcock & Wilcox, built 1941, 22500 # steam hr., at 250 # press.

6—Express Boilers, modified D type, Foster Wheeler, 30,000# steam hr., 435# press., with economizers superheaters, desuperheaters, oil burners, etc.

2—Wickers Boiler 628 H.P. 3 drum. Navy Types, 250 pounds pressure.

6—Cyclotherm 3000 pounds steam per hour, 125 # press.

BOILER FEED PUMPS, TURBINE DRIVEN

1—DeLaval 675 GPM 725# dischge., 4900 RPM, steam 540#

1—DeLaval 600 GPM 575# dischge., 4600 RPM, steam 400#

2—Worth'ton 750 GPM 375# dischge., 3500 RPM, steam 240#

1—Ing. Rand 165 GPM, 575# dischge., 4650 RPM, steam 375#

3—DeLaval 125 GPM 575# dischge., 7000 RPM, steam 400#

CENTRIFUGAL PUMPS

60—Various sizes up to 15,000 GPM, up to 725# disch. pr. steel and bronze motor and turbine driven.

RECIPROCATING STEAM PUMPS

50—Simplex and duplex, various sizes, bronze and steel.

CENTRIFUGES

15—Sharples, 15—DeLaval: Oil purifiers and oil clarifiers capacity 100 GPH and 150 GPH, with motors and pump

HIGH PRESSURE COMPRESSORS

2—Ingersoll Rand type 40, 4 stage 3000# press. 20 cft. driven by G.E. 3/60/220/440 motors and 50 HP

1—same, driven by Waukesha gas engine model GBZ 1111

2—Ingersoll Rand class B, 3 stage, 3,000# press, 7½ cu. ft., driven by G.E. 3/60/440 motors, 24 HP.

DISTILLING PLANTS

2—Griscom Russell Soloshell double effect, 8000 gals. per day, complete with pumps

3—Cleaver Brooks Co., 5000 gals. p. day, self contained units complete with boiler pumps and fans

2—Foster Wheeler 40,000 gallons per day, triple effect low pressure.

1—Condenser Service 80 tons per day, double effect

1—Vapor compression distiller, Badger & Sons, 750 gals. cap.

FANS

150—from 3,000 to 16,000 CFM at 2" to 3" S.P. with AC and DC motors.

FEED WATER HEATERS

FUEL OIL HEATERS

7—Blowers (Roots Connersville) size 16" x 18", connected to G.E. induction motor, 200 H.P., 3 phase 60 cycle, 2200 Volt, 705 RPM

2—Blowers (Roots Connersville) size 20" x 23" connected to Westinghouse Electric induction motor 350 H.P., 3 phase 60 cycle, 2200 Volt, 590 RPM

Blower Motors also sold separately.

WRITE OR CALL FOR DETAILS

HUGO NEU CORPORATION

31 Nassau Street — New York 5, N. Y.

Tel.: REctor 2-1334

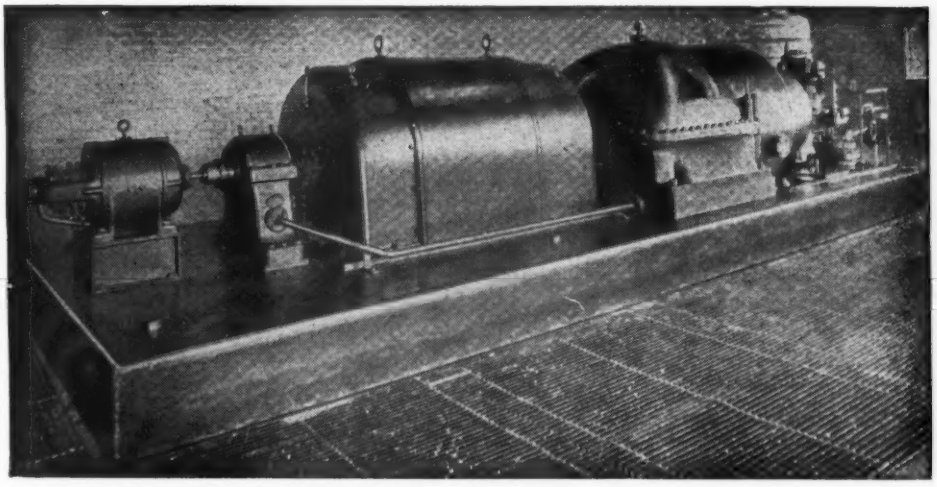
ARRANGE FOR INSPECTION

TURBO-GENERATORS

SPECIAL: Three (3) 450#-psi., 720 F.TT., Turbo-Generators 1—5000-KVA., 2—2815-KVA., Both General Electrics 5000-KW., 2300-V., Also (2) 2815-KVA., 480-V: Both 450# psi., 720° F.TT.

IMMEDIATE DELIVERY

SEND FOR BULLETIN 249



SPECIAL Note Items Listed Below

MODERN NO. 1 CONDITION, 1875-KVA
Inspection in Operation by Arrangement: 2300-V. 300#-PSI. 550 Deg. F. TT.

NEW (UNUSED) EQUIPMENT

25 To 60% SAVING Over Acquisition Costs: *Investigate*

20—CONDENSERS—Never Used: Surface Type: (8280 to 585 sq. ft. Capacities)

20—EJECTORS (NEW)

30—PUMPS—NEW (Condensate-Centrifugal)

RECENTLY PURCHASED OUTRIGHT AND NOW IN OUR STOCK: IMMEDIATE DELIVERY

TURBINE-GENERATORS: NEW: 6-312 DC. WESTINGHOUSE, 440#—PSI. MANY OTHERS: ALL HIGH PRESSURE: MODERN: NEW

For Anything Needed in Power Plant equipment—Write Us and Save Dollars
We Have Diesel Engines, Diesel Electric Power Units, Evaporators, Feed Water Heaters, Lighting Plants (Electric and Gas)

***Used Equipment:* Our Stock of Used Turbo-Generators, Condensers and Boilers, Etc., is Very Complete—It is covered by our Bulletin #249**

WE ARE ALWAYS IN THE MARKET TO PURCHASE FOR CASH GOOD POWER PLANT EQUIPMENT NEW AND USED

Telephone Cadillac 1340-1

Bulletin 249 is Worth Filing for Reference Send for It.

CHARLES WEAVER & COMPANY

Engineers

4045 Penobscot Building

Detroit 26, Michigan

WIRE OR WRITE
Send us Your Specifications
Impossible to List all of OUR STOCK.

REBUILT POWER EQUIPMENT—READY TO SHIP

TURBO GENERATOR SET

750 kw. G.E. Curtis Steam Non-Condensing 220/440 or 2300 v. 3 ph. 60 cy. A.C. complete.

M.G. SETS
250 V. D.C.

(Motors 220/440 or 2200 V. 3 ph. 60 cy.)

No.	KW	Make	Speed
2	15	West.	1150
1	20	West.	900
2	40	West.	850
5	50	West.	1200
2	75	Star	1200
2	75	G.E.	600
4	100	Star	1200
1	150	G.E.	1200
1	150	Cr. Wh.	720
1	200	Elliott	1200
1	200	Cr. Wh.	720

Can furnish M.G. Sets at 125 V.D.C. from 5 kw. up to 100 kw. for immediate shipment from stock.

DYNAMOMETER

"Hi-Eff" hydraulic size 35#, model 58S, 3100 rpm., Taylor Mfg. Co.

FREQUENCY CHANGERS

3—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir. con. to 25 HP, 1800 rpm., 220/440 v. 3 ph. 60 cy. motors

COMPRESSORS

2—315 cu. ft. 100 lb. pres. Ingersoll-Rand, Models 315 and 315A portable Air Compressors with 105 HP Waukesha Oil Engines, complete with accessories.

1—630 cu. ft. 100 lbs. pressure Burry Horiz. Compressor.

INDUSTRIAL TRUCKS

5—Automobile type LO-5 Low Lift Electric Trucks capacity 5 ton platform type.

5—New 4 ton Yale & Towne Model Y8W Multi-stroke Hand Lift Platform.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph. 60 cy. 150 A. enclosed type.

CONVEYOR SYSTEM

Palmer Bee—open chain & trays complete with 5 HP. A.C. motor, Reeves drive, Worm Gear Reducer 90.6 to 1, Unit mt'd on I Beam, platform 42x96", 1928' of 4" open link chain, 727 tray hooks & trolley, curves, rollers, etc.

PROPELLER FANS

11—New American Blower mtd. in cylindrical casting with flanged ends 24" opening one end, 30" other end, 16½ deep, blades 11" long direct driven 1 HP., 220/440 v. 3 ph. 60 cy. 1140 rpm., Motors.

TESTS STANDS

3—Dennison Eng. Co. portable, hydr. model PHTS-2, 7 GPM constant volume dir. con. 7½ hp. A.C. motors, 3000 lb. pres. capacity.

DEGREASER

Blakeslee, Liquid fully conveyorized, immersion loading and unloading at opposite ends, 13' long 5'3" wide, 10'8" high with ¾ HP. A.C. motor. Conveyor speed 9 rpm., dual vapor control, gage glasses, thermometers, necessary piping and fittings, double strand chain conveyor with cross rods. 25"x20"x3" deep baskets, ⅜" Sacro TR-40-3 Water Control, 1½" Sacro SF, 11 Vapor control, storage Tanks, #3 Still, Trans. pump and motors.

DUST COLLECTING UNITS

5—NEW portable, self contained ¼ HP. A.C. Motors, overall Diam. 25"x14½"x23 single inlet, single outlet Fried Air Kool Co.

WINCHES

240—Winch assembly portable engine hoists, swivel hook, 4⅝" l, with 1½" opening and 30' of ¼" cable. Hand cranked, double reduction gear with drum 5¾" w. can be used with A.C. or D.C. Motors.

PRESSES

2—Bliss hydro Dynamic marking vertical with 5 HP. A.C. motors 30 ton capacity.

LIFTING MAGNETS

3—54" E.C. & M. Co. rectangular, model #3, type F 230 v. D.C.

INDUSTRIAL VACUUM CLEANERS

5—Sturtevant type F with ¾ HP. A.C. Motors.

RADIAL DRILLS

Chic. Pneumatic Tool Co. portable or stat. swing arm length 72" reach.

Chic. Pneumatic Tool Co. portable or stat. swing arm length 31" capacity.

½" Jacob Chuck

WELDING AND PLATING SETS

1—Chandeysson 50 KW., 40 V. D.C. 600 rpm., 75 HP. Synchronous Motor 220/440 v. 3 ph. 60 cy., with exciter 100% P.F.

1—Thompson Shell Welder including West. control, 6 electronic tubes, ½ HP. A.C. Motor.

1—Federal special seam welder 200 kva., 220/440 v. 60 cy., 5 DC max. sec. amps. 34000 at ¼ x 33 throat, sec. volts 5.1 10.2 max. air pres. 90 min. water inlet pres. 65# 70 deg. F max.

1—Federal seam welder 150 kva., 220/440 v. 60 cy., .5 DC max. sec. amps. X30,000 at 4 BY-28 throat sec. volts 4-8 max. air pres. 90 deg. min. water inlet pres. 50 lbs. at 70 deg. F. 1 HP. AC. Motor.

CONDENSER OR SYN. MOTOR

500 HP. Elec. Machinery Co. SYN Motor 80% P.F. 120 rpm., 4000/2200/440 or 220 v. with exciter.

POWER PLANTS

5—NEW 1½ kw. Homelite portable 115 v. 1 ph. 60 cy. 1 cyl. air cooled 2 cycle gas or gasoline.

1—5 kw. Engberg Steam Engine 220 V. D.C.

2—5 kw. Portable Master Elec. 110/220 v. 1 ph. 60 cy. 4 cyl. Wis gas or gasoline engines 80% P.F. pneu. tires.

1—7½ kw. port. Master 4 cyl gas or gasoline 120 v. 1 ph. 60 cy. with pneu. tires and tongue.

2—10 kw. 120/v. Star Generators dir. con. to Hercules DIESEL, 250.

1—25 kw. 120/208 v. 3 ph. 60 cy. 80% P.F. West. Gen. dir. con. to Le Roi Gasoline Engine.

2—30 kw. 125/v. G.E. Generators dir. con. Buda DIESEL.

1—35 kva. Ridgway 220/3/60 dir. Con. Ridgway STEAM engine.

1—125 kva. West 240/480 v. 3 ph. 60 cy. West. dir. con. Erie Ball STEAM Engine.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

NEW—REBUILT & GUARANTEED MOTORS — M-G SETS — TRANSFORMERS

NEW MOTORS

3 ph. 60 cy.

Qn.	H.P.	Make	Volts	Speed	Type
60	1	Peerless B. Brg.	220/440	1800	P188
5	2	West. T. E. F. C. B. B.	220/440	1800	CSP-224
3	2	Dayton B. Brg.	220/440	1800	224
3	3	Dayton B. Brg.	220/440	1800	225
1	3	West.	220/440	1800	CSP-225
1	3	West.	220/440	1200	CS-254
1	3	Wagner	220/440	1200	RPI-254
1	3	Brown & Brook.	220/440	1800	225
10	5	West. B. Brg.	220/440	1800	CSP-254
1	5	West.	220/440	1200	CSP-254
1	15	G.E. B. Brg.	220/440	1800	K-326

1 ph. 60 cy.

2	1½	G.E. Exp. Pro.	115/230	1800	SCR-224
11	¾	B-Line	115/230	1800	RS-720-R

TRANSFORMERS

Qn.	KVA	Cycle	Voltage	Make	Type
1	2	60	2300/115/230	G.E.	H
1	2½	60	2300/115/230	G.E.	H
1	3	60	2300/115/230	G.E.	H
1	3	60	2300/110/220	Pitts.	
1	5	25	440/110/220	Pitts.	
1	5	25	2220/220/110	West.	S
2	7½	60	2200/220/110	West.	
1	10	25	2300/230/115	G.E.	H
5	15	60	2300/110/220	Pitts.	
1	15	60	2300/115/230	G.E.	
3	25	25	2300/115/230	Pitts.	
2	50	60	2200/110/230	Pitts.	
1	50	25	2300/230/460	Pitts.	
3	75	60	2200/120/240	G.E.	H-K
1	10,000	60	33,200/4,600	Pitts.	

A.C. MOTORS

3 ph. 60 cycle

Qn.	H.P.	Make	Type	Volts	Speed
10	½	G.E.	KT	220/440	3600
5	½	G.E.	KT	220/440	1800
4	2	G.E.	KT	220/440	1200
1	2	G.E.	Exp. Proof	220/440	1800
1	2	West.	Vertical	220/440	1200
2	3	G.E.	KT	220/440	900
2	3	West.	CSP-254	220/440	1800
1	7½	G.E.	KT-180	220/440	1800
2	10	W. B. Brg.	CS-326	220/440	1200
4	10	Al. Ch.	AN	220/440	1200
2	10	West.	CS	220/440	1200
1	15	W. B. Brg.	365	220/440	1200
5	15	Al. Ch.	AN	220/440	1200
1	15	G.E. B. B.	KT	220/440	720
1	20	G.E.	I-K	220/440	600
2	20	Wagner	BP	220/440	1300
1	25	Gen. Elec.	KT	220/440	900
4	25	Al. Ch.	AN	220/440	1200
1	25	Cr. Wh.	Sl. Rg.	220/440	1200
1	25	Lincoln		220/440	1200
2	30	W. E.	KT	220/440	900
3	30	Al. Ch.	AN	220/440	1200
2	30	West.	CS	220/440	720
3	35	G.E.	I-K	220/440	900
1	35	Al. Ch.	AN	220/440	1200
2	40	Gen. Elec.	IK	220/440	1200
1	50	Gen. Elec.	KT-346	220/440	900
2	50	Gen. Elec.	K7337	220/440	1800
3	50	West.	CS	220/440	1800
2	60	Allis Chal.		220/440	1800
1	60	Rob. Meyers	K-209	220/440	1200

A.C. MOTORS

3 ph., 25 cycle

Qn.	H.P.	Make	Type	Volts	Speed
18	2	G.E.	KT-731	220/440	750
5	5	Howell	SC-232	220/440	750
14	5	G.E.	KT	220/440	750
5	5	West.	CCL	220/440	750
1	7½	West.	CS	220/440	750
4	7½	G.E. Sl. Rg.	I-M	220/440	750
2	10	West.	CS	220/440	500
1	10	G.E.	I-M	220/440	750
1	10	G.E.	KT	220/440	750
1	15	Howell B.B.	SCR	220/440	500
1	15	G.E.	I	220/440	750
2	15	Gen. Elec.	IK	220/440	750
2	20	Gen. Elec.	IK	220/440	750
3	20	G.E.	KT	220/440	750
1	20	W. Sl. Rg.	CW	220/440	750
2	25	G.E.	I-K	220/440	750
1	25	W. Sl. Rg.	CW	220/440	750
1	25	Burke S. R.	WEV	220/440	750
2	25	Gen. Elec.	KT-337	220/440	750
2	25	Westinghouse	CS	220/440	750
2	30	Allis Chal.		220/440	750
1	60	Gen. Elec.	IK	220/440	500
1	100	G.E.	I-K	220/440	750
1	200	West.	CS	220/440	750
1	200	G.E.	I-K	220/440	750
1	3	G.E.	KT-160	220/440	1500
7	5	G.E.	KT	220/440	1500
2	5	G.E. Sl. Rg.	MT-181	220/440	1500
7	5	West.	CS	220/440	1500
1	7½	G.E.	I-K	220/440	1500
1	15	West.	CS	220/440	1500
1	25	Wagner	BP	220/440	1500
1	250	G.E.	I	220/440	1500

STEAM POWERED GENERATOR

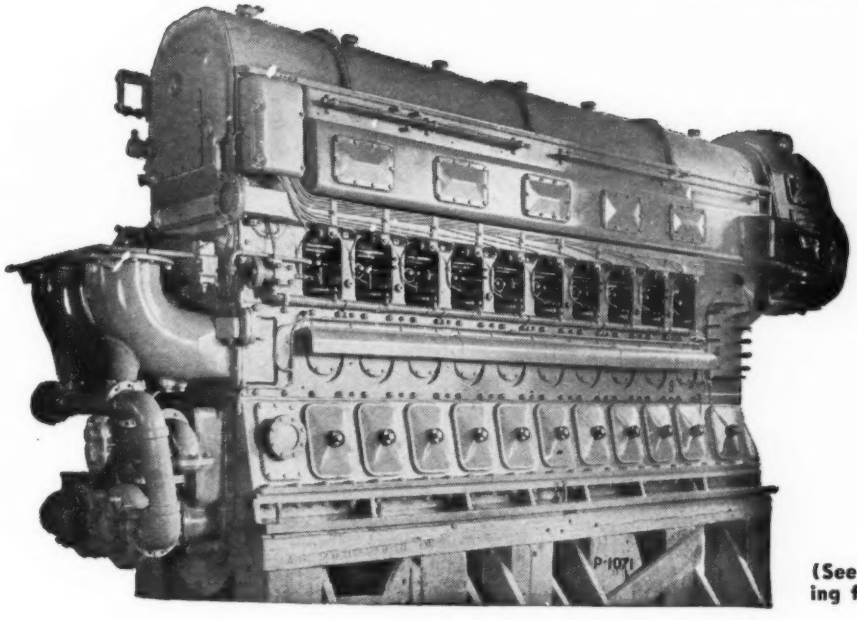
(1) Hoover Owen Renschler 750-H.P., Uniflow Steam Engine direct connected to 500 KVA Crocker Wheeler Generator, 250 volts, 150 RPM. Complete with accessories and control panels.

We buy for cash. Send us your list of surplus equipment.

VOLLAND ELECTRIC EQUIPMENT CO., INC.

1512 NIAGARA STREET — **PHONE GR 2715** — **BUFFALO 13, N Y.**

ENGINEERED AGSCO DIESEL POWER



3000 KVA PLANT CONSISTING OF:

3—1000 KVA, 800 KW, 3 phase 60 cycle, 2300 volt. Westinghouse, 600 RPM, Direct Connected to:

3—1250 H.P. Fairbanks-Morse Diesel Engines, Model 38D8⅛, 10 cylinder, 8⅛" bore 10" stroke, 600 RPM.

(See photo at left of similar unit prior to loading from our plant #1 Jersey City.)

These three units are offered with complete equipment—switchboards, auxiliaries cooling equipment and silencing equipment.

DIESEL GENERATORS

ALTERNATING CURRENT

(60 and 50 cycles)

KVA	MAKE	HP	MODEL	RPM	YEAR
2—1875	Fairbanks Morse	2000	33E16	300	1939
1—1250	Nelseco	1500	6M1-53	300	1931
8—1250	Fairbanks Morse	1700	38D8⅛	720	1944
12—1250	General Motors	1600	16-278-A	720	1944
3—1000	Fairbanks Morse	1250	38D⅛	600	1944
1— 625	Superior	750	OS	327	1938
1— 312	Enterprise	450	D8G-8	450	New
1— 300	Fairbanks Morse	360	YVA	257	1928
1— 250	General Motors	300	8-268-A	900	New
4— 250	General Motors	400	8-268-A	1200	1945
6— 125	General Motors	200	8-268-A	1200	1944
3— 94	General Motors	125	6061	1800	New
1— 94	Buckeye	112	E	400	1936
4— 75	General Motors	90	6061E	1200	New
13— 62	International	75	UD18	1200	New
8— 37	General Motors	45	3-71	1200	New
15— 18	International	30	UD6	1200	New

What are your requirements?

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AG SCHOONMAKER CO INC.

50 CHURCH STREET NEW YORK 7, NEW YORK

Cable Address: AGSCOMACH PHONE: Digby 9-4350

Business Est. 1898

DIESEL POWER

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

2—6250 KW Gen. Elec. Cond. 25 Cycle
1—5000 KVA General Electric Cond.
1—4000 KW General Electric Cond.
2—3750 KVA Westinghouse Cond.
1—3750 KVA Westinghouse Extrac.
1—3125 KVA General Electric Cond.
2—3125 KVA General Electric Extrac.
2—1250 KVA General Electric Cond.
2—1250 KVA Elliott Cond.
1— 225 KVA General Electric Non-C.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Chuse Uniflow
1—450 KVA Ames Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—312 KVA Ames Uniflow
1—300 KVA Skinner Uniflow
1—225 KVA Skinner Uniflow
1—150 KVA Harrisburg 4-valve
1—125 KVA Ames Uniflow

D.C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—275 KW Ames Uniflow, 250 V.

DIESEL ENGINE UNITS

2—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
1— 750 HP Worthington, 250 V., 60 cy. gen.
1— 750 HP Cooper Bessemer, 460 V., 60 cy. gen.
4— 720 HP Amer. Loco., 240 V. DC.
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 500 HP Gen. Motors, 480-2400 V. gen.
1— 300 KW Buckeye, 450 V. 60 cy. gen.
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

WATER TUBE BOILERS

1—1409 HP, B. & W., 650-lb. Stokers
2— 748 HP Edgemoor 250-lb. Stokers
2— 560 HP Erie City 460 lb.
1— 519 HP Titusville 200-lb., Stoker
5— 492 HP Heine, 180-lb. Stokers
2— 469 HP B. & W. 425-lb. Pulverizer

SYNCHRONOUS MOTORS

4—6000 HP G. E. 60 cy. 2300 V. 90 RPM
4— 400 HP West. 2300 V. 600 RPM
1— 300 HP G. E. 60 cy. 2200 V. 600 RPM
1— 300 HP West. 60 cy. 2300 V. 900 RPM
1— 200 HP West. 60 cy. 2300 V. 900 RPM
1— 100 HP G.E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS

1—1000 HP West. S/R, 2200 V. 360 RPM
1— 200 HP G.E. S/C, 2300 V. 1800 RPM
2— 150 HP Burke S/C, 440 V. 1800 RPM, New.
1— 150 HP G.E. S/C, 440 V. 600 RPM
1— 150 HP G.E. S/C. 2300 V. 1800 RPM
2— 120 HP G.E. S/C, 220 V. 3600 RPM

MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC, 60 cy.
1— 500 KW Cr. Wh. 600 V. DC, 60 cy.
1— 400 KW Cr. Wh. 275 V. DC, 60 cy.
1— 400 KW Allis Chal. 275 V. DC, 25 cy.
2— 300 KW Allis Chalmers, 275 V. DC, 25 Cy.
1— 300 KW Westinghouse 250 V. DC, 60 cy.
1— 250 KW Allis Chal. 275 V. DC, 25 cy.
2— 225 KW Gen. Elec. 115 V. DC, 60 cy.
2— 125 KW Westinghouse 115 V. DC, 60 cy.
1— 75 KW Westinghouse 125 V. DC, 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
1—1000 KW Allis Chalmers 600 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW General Electric 275 V.

FREQUENCY CHANGERS

1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
1—1200 KVA G. E. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.

2— 2000 KVA West. 69/34.5-4.8/2.4 KV
1— 3500 KVA West. 33000/13800—3 ph.
4— 333 KVA Al. Ch. 25410/44000-13200/23000Y V.
1—10000 KVA West. 26400-4580 V.—3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
1— 1000 KVA G. E. 24000-11500 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
1— 3750/5000 KVA West. 22000/460 V. 3 ph.
1— 3000 KVA Kuhlman 13800-240 V.—3 ph.
2—10000 KVA Pittsburgh 13200-4600 V. 3 ph.
2— 1000 KVA G. E. 11500/23000-575 V.
1— 1500 KVA Al. Ch. 2400-480 V.
3— 75 KVA G. E. 2300-575 V.
3— 250 KVA Moloney 2300-240/480
1— 1500 KVA Al. Ch. 240/480 V.

OIL CIRCUIT BREAKERS

1— 400 A. 37 KV West. G11		Outdoor
2— 400 A. 25 KV G. E. FKO136		Outdoor
2—1000 A. 23 KV Kelman CB76		Outdoor
6— 600 A. 15 KV G. E. FK255		Indoor
4— 600 A. 15 KV G. E. FHKO139-24BS		Outdoor
1— 600 A. 15 KV G. E. FKO37		Pole type
2— 400 A. 15 KV G. E. FHKO136		Outdoor

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Special Offerings

TURBO-GENERATORS

3— 3,000 KW 600 V Cond.
1— 2000 KW 600 V Cond.
1— 2000 KW 480 V N.C.
2— 1500 KW 2300 V Cond.
1— 1250 KW 2300 V. Cond.
1— 1000 KW 440 V. Extrac.
1— 1000 KW 2300 V Cond.
1— 750 KW 240 V Extrac.
2— 500 KW 600 V Cond.
1— 500 KW 240 V Cond.
1— 250 KW 240 V N. D.
1— 125 KW 600 V Extrac.
1— 50 KW 220 V AC, N.C.

ENGINE GENERATORS

2—600 KW. 2300 V. Uniflow
1—168 KW. 600 V.

1—280 KW. 480 V.
1—250 KW. 480 V.
1—150 KW. 480 V.
1—125 KW. 125/250 V.D.C. Uniflow

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#

BOILERS

1—90,000# 550 PSI
1—50,000# 250 PSI
1—30,000# 425 PSI
2—507 HP 160#
1—500 HP 400#
1—460 HP 250#
1—200 HP 160# HRT
1—150 HP 150# HRT
1— 75 HP 150# NEW

AIR COMPRESSORS

1—6000 CFM 50# Motor
1—1573 CFM 100# Motor
1—1300 CFM 50# Steam
1—1700 CFM 100# Steam
1—5000 CFM 10# G. Rotary Type Driven by 440V. Syn. Motor.

TRANSFORMERS

3—200 KVA 600/220/110

MOTOR GENERATORS

1—100 KW 550/125V

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SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM, 6 PH. 60 CY, SWITCHGEAR AND TRANSFORMERS.

300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM. 6 PH. 60 CY. SWITCHGEAR AND TRANSFORMERS.

300 KW G.E. 600 D.C. 11500/13200 A.C. 1200 RPM. 6 PH 60 CY. COMPLETE FULL AUTOMATIC G.E. SWITCHGEAR.

MOTOR GENERATORS

500 KW G.E. SYN. 600 V. 2200/4000 A.C. 1200 RPM, 3 PH. 60 CY COMPLETE MANUAL SWITCHGEAR.

300 KW RIDGWAY SYN. 250 V. 2200 A.C. 1200 RPM, 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

200 KW G.E. SYN. 250 V. 2300 A.C. 720 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

150 KW WEST. SYN. 250 V. 2300 A.C. 900 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

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Every Set Completely Tested To Insure Guaranteed Performance

600 KW M.G. SET

600 KW Crocker Wheeler type CCD compound interpole 250 volts d.c. gen. 720 RPM, with 870 KVA Crocker Wheeler synchronous motor 3/060/480 (2300 volts) 720 RPM, complete.

90 KW MOTOR-GENERATOR SETS

90 KW, General Electric, type CD-1251, compound, interpole, 60 volts d.c. generators, on factory base with 135 HP General Electric, type TS-955Z synchronous motors, 3/60/2300/440 volts. Complete with A.C. 2300 volt synchronous motor starters, and D.C. generators panels.

MOTOR GENERATOR SETS

KW	Make	AC	DC
1000	G.E.	2300	600
800	Wtg.	13200	240
500	G.E.	6600	250
500	G.E.	2300	250
300	G.E.	440	220
300	G.E.	2300	250
200	G.E.	440	250
150	Ft. Wayne	440	250
150	G.E.	2300	230
100	A. Ch.	2300	275
90	G.E.	440	275
90	G.E.	2300	60
75	Wtg.	2300	110
75	Ele . Pdts.	220	125
75	Wtg.	220	250
65	G.E.	450	125
60	A. Ch.	2300	110
50	G.E.	220	250
50	C. Wh.	230	240
40	G.E.	440	125
40	Imp.	440	250
30	Wtg.	440	250
30	G.E.	440	230
25	Watt.	220	97/111

DC MOTORS

HP	Make	Type	Volts	Speed
430	G.E.	MPC	250	950
200	Wtg.	SK	230	1150
125	Wtg.	SK	230	1400
100	G.E.	RC	220	2500
60	G.E.	CD	550	1000
45	Wtg.	SB	250	650
40	G.E.	LC	250	825/2000
40	C. Wh.	CCM	230	575
40	G.E.	E	220	620
35	C. Wh.	CM	220	840
35	Sprague	C	230	300/900
30	Sprague	C	230	240/300
30	Triumph		230	25/750
30	Wtg.	SA	220	400/1200
30	C. Wh.	CCM	220	450
30	A. Ch.		230	575
25	A. Ch.	SB	220	700
25	Wtg.	S	220	850
25	N. West.	K	230	900
25	G.E.	CL	220	725
25	Wtg.	S	220	560/780
25	G.E.	DLC	220	500/1000
25	G.E.	LC	250	825/2000
25	Wtg.	SK	230	00/1200
25	M. Card	BB	220	1800

25 CYCLE A.C. MOTORS

HP	Make	Type	Volts	Speed
60	Wtg.	CS	440	715
20	Burke	EM	440	750
20	Wtg.	CS	440	715
17	Burke		220	500
15	Burke	EM	440	750
15	G.E.	KT	220	725
15	G.E.	KT	220	715
15	G.E.	ITC	440	750
5	C. Al.	HD	440	1400/730 466/235

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
500	G.E.	TS	2300	450
450	Elec. Mach.		440	240
300	HP	Ideal	2300	300
300	Elec. Mtr.		440	900
250	G.E.	TS	2300	600
200	G.E.	TS	2300	720
60	G.E.	ATI	220	900
60	G.E.	TS	220	1200
15	Cent.	IOBF	208	1200
5	G.E.	K	208	

SLIPRING MOTORS

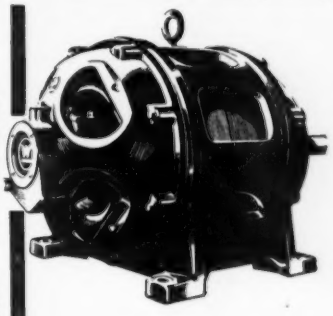
HP	Make	Type	Volts	Speed
1200	Wtg.	CW	2200	600
600	G.E.	IP	6600	300
400	G.E.	MT	2200	450
400	A. Ch.		4000	1180
350	G.E.	IM	440	720
250	G.E.	IP	440	450
250	G.E.	IM	440	720
200	G.E.	IM	2200	600
150	Wtg.		220	1800
100	G.E.	IM	440	720
75	Wtg.		220	1200
50	G.E.	MT	440	1800
50	L. Al.	GH	440	870
40	G.E.	MT	220	1200
40	G.E.	MTC	220	1160
40	G.E.	MT	440	860
35	F. M.	UAV	220	1800
35	Wtg.	CW	440	1200
35	G.E.	I	440	1140
30	G.E.	MT	220	570
30	Line.	FR	220	900
30	Star		440	720/360
30	G.E.	I	440	1150
30	G.E.		2200	1745
25	G.E.	MT	440	1125
25	G.E.	IM	220	1140

GEAR HEAD MOTORS

HP	Make	Type	Volts	Speed
5	G.E.	K	440	1800/98.9
3	Ster.	KFA	440	1800/350
3	G.E.	KT	440	1155
2	Ster.	KFA	440	230
2	Ster.	LFB	440	1800/59
2	G.E.		440	100
1½	G.E.		440	230
1½	G.E.		440	37
1½	G.E.	KH	115	1725
1½	Ster.		440	88
1½	G.E.		440	98.6
1	G.E.		440	190
1	U. S.		440	230
1	U. S.		440	350

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
500	G.E.	I	440	1200
250	G.E.	IK	440	600
200	Wtg.	CCL	440	1200
150	Cent.	A	440	1800
150	G.E.	E	440	1180
150	G.E.	TEFC	440	960
150	G.E.	IK	440	900
150	G.E.	E	440	1800
150	Cent.	A	440	1800
125	How.		440	1200
125	A. Ch.		440	435
100	Cent.		440	1800
100	F. M.	TEFC	440	3600
100	Wtg.	CS	440	720
100	G.E.	K	440	1200/900/600/450
100	A. Ch.	AR	440	495
100	G.E.	IK	440	600
75	G.E.	KT	440	900
75	G.E.	KF	440	1200
75	Cent.		440	1800
75	G.E.	IK	2300	900
75	A. Ch.	AR	2200	1765
75	A. Ch.		440	1130
60	A. Ch.	AR	440	495
60	Wtg.	CS	440	1800
50	How.	TEFC	440	500



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MOTORS
3 PHASE—25 CYCLE—220/440 VOLTS

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West.	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		500
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	871.52C	1460
125	West. (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	480

MOTORS
3 phase, 60 cycle—220/440 volts

H.P.	Make	Type	RPM
5	American	Splash Proof BB.	1200
5	G.E.	Tri Clad	1750
5	G.E.	I Form K	680
7½	Amer. El.	Splash Proof BB.	1200
10	Amer. El.	Vertical BB.	1200
10	G.E.	KT956	1200
10	G.E.	KT752	1200
15	G.E.	KT312	855
15	West.	CS	1155
20	West.	New BB.	1200
20	G.E.	Tri Clad BB.	3600
20	West.	New CS365	1800
25	West.	New CS444	900
25	West.	CS	1200
30	West.	New CS445	900
30	West.	CS	1200
40	Cr. Wh.		685
40	Lincoln	IM	720
40	G.E.	KT323	1740
50	Al.-Ch.		1800
50	Al. Ch.		1800
60	G.E.	I	1800
60	Whse. 2200V.	CCL	1200
75	Westhgse.	CS	1800
100	Westghse.	CCL	1803
125	Westghse.	CCL	1800
125	Westghse.	CS	1200
150	Westghse.	CS	1800
150	G.E.	IK	1200
250	G.E.	I-K	600
300	G.E.	I-K	720
400	G.E.	I-K	900

H.P.	Make	Type	RPM	Ser. No.
50	Al. Ch.		1800	3K28825
60	G.E.	I	1800	292596
60	Whse. 2200V.	CCL	1200	854121
75	Westhgse.	CS	1800	2134671
100	Westghse.	CCL	1803	1043213
125	Westghse.	CCL	1800	765231
125	Westghse.	CS	1200	2318625
150	Westghse.	CS	1800	2429726
150	G.E.	IK	1200	
250	G.E.	I-K	600	2246834
300	G.E.	I-K	720	2357743
400	G.E.	I-K	900	2347845

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle if desired.

25 CYCLE TRANSFORMERS

3—500 KVA Pennsylvania Transformers 25 Cycle, 1 Phase, 2300 Volts Primary 230/460 Volts Secondary.

60 CYCLE TRANSFORMERS

1—3000 KVA Kuhlman Transformer 60 Cycle, 3 Phase, 14,160 Volts Primary 240 Volts Secondary.

25 CYCLE GEARED MOTORS

3—10 H.P. Westghse., Frame 364 Encl. 1500/378 RPM.
1—15 H.P. Master, Frame 405 Encl., 1450/416 RPM. Exp. Proof.

D.C. CIRCUIT BREAKERS

4—800 Amp. ITE air breakers 2 pole 250 volts complete with overload trips 600/1200 Amp.—mounted on slate panels.

MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP 3 Phase 25 Cycle motors.
1—30 KW Gen. Elec. Generator, Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440/60/720 RPM. with panel board.

SPECIAL

1—150 HP. Fairbanks Morse Ball Bearing Motor. 3/60/440/1800 RPM.
1—75 HP. Fynn-Weischel (Wagner) Synchronous Motor Serial #345781, 3 Phase 60 Cycle 440 Volts, 1200 RPM.
1—75 HP. Fynn Weischel Synchronous Motor 3 Phase 60 Cycle 440 Volts 1200 RPM. with starting control.
1—150 HP. Fairbanks Morse Ball Bearing motor 3/60/440/1800 RPM.
1—300 HP. Gen. Elect. Synchronous Motor. Type ATI. 3/60/440/1200 RPM., .8 PF. with direct connected exciter and starting equipment.
1—300 HP. Gen. Elect. Squirrel Cage Motor. Type 115—3/60/440 1200 RPM. with starting equipment.

NEW MOTORS

100—New motors from ½ HP. to 30 HP. in stock, 60 Cycle single and 3 Phase.

ROTARY CONVERTER

1—2000 KW. Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

AIR COMPRESSORS

2—5000 CFM Worthington low pressure 45 lb. Compressors with 500 H.P. Gen. Elect. Motors. 3 phase 25 cycle 2300 volts.—Complete.
2—1000 CFM 100 lb. Compressors Driven by 200 HP. Motors.
1—1700 CFM Worthington 2 Stage 100 lb. with motor.

2—5000 CFM. Worthington 45# low pressure. Complete with 500 HP. Gen. Elect. Synchronous motors, 3 Ph. 25 Cy. 2300 Volts.

2300 VOLT PRIMARY CONTACTORS

2—150 H.P. Westinghouse AC magnetic controllers 3/60/2300 V.
1—225 H.P. Square D magnetic controller 3/60/2300 V.
2—200 Amp. Schweitzer-Conrad Load Breaks—3 Pole Fused. 3/60/2300 V.

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124 CHURCH ST. BUFFALO, N. Y.
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Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGER SETS

MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
TRANSFORMERS, LARGE STOCK
D. C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D. C. Motors
230 Volts D.C. Motors
550 Volts D.C. Motors

THE FRED W. KIEMLE CO., 33 N. SUPERIOR ST., TOLEDO 4, OHIO

Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

IMMEDIATE DELIVERY

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NEW ELECTRIC MOTORS

(All 60 cycle)

Quantity	H.P.	Speed	Phase	Voltage	Name	Description
250	1/6	1750	1	110	Jack & Heintz	Cap. S. B.
225	1/4	1750	1	110	Jack & Heintz	Cap. S. B.
50	1/4	1140	1	110	Marathon	Spl. Phase, S. B.
400	1/4	3450	1	110	Standard	Cap. B. B.
350	1/3	1750	1	110/220	Jack & Heintz	Capacitor S. B.
390	1/3	3450	1	110/220	Standard	Cap. B. B.
400	1/2	3450	1	110/220	Standard	Cap. B. B.
80	5/8	3450	3	220	West.	TE. BB. Gov. Issue
150	3/4	1200	3	220	West.	TE. BB. Gov. Issue
200	1	1800	3	220/440	Louis Allis	Ex. Pr. B. B.
51	1½	1800	1	110/220	Leland	Ex. Pr. B. B.
19	5	660	3	220/440	Wagner	T.E.F.C. B.B.
20	5	700	3	208	Master rule	Hi-Slip Hi-Torque Gearhead-TEFC-B.B.
50	5	1800	3	220/440	U. S.	Drip Pr. B. B.
20	1/4	1800	D.C.	115	G.E.	Drip. pr. C P.D.
30	3/4	1800	D.C.	115	Peerless	Drip. pr. B.B.
2	10	850/1275	D.C.	220	G.E.	Rebuilt like new

9—B. B. Generators, 1/3 KW, Pincor 28 to 32 Volt, 1800 D.C.

2—2000 amp M.G. sets, 6 to 8 volt, Bouge manufacturer.
2—1000 amp M.G. sets, 12 to 16 volt, Bouge manufacturer.

We specialize in all sizes and types of Motors and Starting Equipment, Generators, Transformers and Compressors.

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Two Jones Underfeed Stokers, including Jones-Troy engine, Cole automatic valves, retorts, dead plates, tuyeres, rams and hoppers. Good operating condition, some parts new.

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45 KW M.G. Set 2200 AC 250 DC
100 KW M.G. Set 220/440 AC 125/250 DC
285 KW 240 volt Chuse Uniflow engine set
200 KW 480 volt Ridgway engine set.
2500 KW 2300 volt G.E. Cond Turbine set
200 KW 1800 rpm 440 volt TEFC Motor

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

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Jackson, Miss.

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NEW ILG MARINE BLOWER FANS

24"—6250 C.F.M. 33"—10000 C.F.M.
36"—15000 C.F.M.
Axial Flow—Propeller Type Driven by 230 volt DC Motors.

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Two Kewanee Type "C" No. 7 L 63 Boilers 100 H.P. with Detroit underfeed stokers and direct driven forced draft fan.

Kewanee Type "C" No. 7 L 63 Series IX

Manufacturers rating based on 17 square feet of E.D.R. carrying capacity per square foot of heating surface = 17,900 square feet Boiler Heating Surface = 1,053 square feet
Stokers—Detroit Underfeed
Capacity in lbs. of coal per hour 560.
Direct driven forced draft fan capacity 2,500 cubic feet per minute
Stoker speed can be increased 10 to 15% or more.
No major repairs should be necessary to either boilers or stokers for some time. Arrangements may be made to inspect boilers when not in use.

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3-2000 KVA Each Transformer Single Phase High Tension
1400/2200 KW Turbo-Generator, non-condensing, Excellent Condition

1— 90,000# Boilers 575#
4—100000# Boilers 300#
1—225000# Boiler 450#
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2— 600 H P Edge Moor 200# Stokers
Smaller Boilers and Fire Tube Boilers also
2—3000 K.W. Turbos @ 350#

Several 425# and 550# Turbo-Generators available
2—2500 K.W. G.E. Co., Turbo-Generator Condensing
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1—6500 K.W. G.E. Co., Turbo-Generator Condensing
1—2000 K.W. W.E. & M. Co., Turbo-Generator Con.
2—1000 K.W. G.E. Co., Turbo-Generator Condensing
2— 750 K.W. G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller Units

Non-Conducting Turbos—300—500—750—and 1,000 K. W. & Larger

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CENTRIFUGAL PUMPS

1—7½ H.P., G.E. MT 956, 1200 RPM., SB 220V.
1—7½ H.P., G.E. MT 952, 1160 RPM. SB 440V.
1—7½ H.P., G.E. MT 760, 1800 RPM. SB 220V.
1—20 H.P., G.E. MT 512, 1200 RPM. SB 220V.
1—30 H.P., Westinghouse, CI 900 RPM. SB 440V. Fr. 638.
1—50 KW Westinghouse MG set, 125V. 1150 RPM., compound wound, complete with charging panels.
1—50 H.P. G.E. MT 346Y, 690 RPM., 220V. SB., bare—will not connect to 440V. Will connect 550V.

Penn Electrical Engineering Co.
SCRANTON, PA.

FOR SALE

1—Used Sturtevant Steam Engine, Serial No. 66173, Size 11 x 9, Type VS-7, 328 RPM, with throttling governor,—78 HP. In good condition.

1—Used Sturtevant #996 TVID, Serial No. 300632, Design 2, Induced Draft Fan, BP C-15-10488-B, and spare repair parts. In good condition.

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Rebuilt • Tested • Guaranteed

750 KW Gen. Elec. 8ype HCC 600 volts DC-1200 RPM, 6 ring, 2 or 3 phase 60 cycle, with panel board.
60 KW 250 volt DC Synchronous Converter, 440 volt 3 phase, 60 cycle, 1800 RPM AC with complete accessories.
50 KW 250 volt DC Gen. Elec. synchronous converter, 440 volt, 3 phase, 60 cycle 1800 RPM, AC with complete control equipment.
500 amp. 145 volt DC Westinghouse 3 bearing balancer set.
15 KW A. B. See 2 bearing 220 volts MG set, 1800 RPM driven by 25 HP 220 volt DC motor.
10 KW Hertner Vertical 2 bearing, 220 volt DC 1700 RPM driven by 15 HP 220 volt, 3 ph. 60 cycle 1800 RPM.

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1—2250 KVA, 3 phase, 60 cy., 3600 RPM, Gen. Elec. Turbo Generator, steam pressure 410 lbs. 275° S.H. 725° T.T. with surface condenser.
1—625 KVA, 3 ph., 60 cy., 480 vlt., 900 RPM, Westgh. Generator to a Westgh. non-condensing turbine.
265 new Gen. Elec. transformers 3 to 75 KVA, 450 to 17 vlts.
68 new Gen. Elec. transformers 3300-6600-1100 to 120-240 vlts type HSBA.
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1—360 HP Anderson full diesel, Model 29 257 RPM with clutch and pulley on one end to drive an ice machine or any other machine and a 125 KVA, 3 phase, 60 cycle, 240 volt Generator direct connected on opposite end.
1—90 KVA, 3 ph., 60 cy., 2300 V, Fairbanks Morse Generator connected to a 2 cylinder Fairbanks Morse full diesel type Y, style VA.
1—156 KVA., 3 ph., 60 cy., 240 volt, 1200 RPM, type ATB frame 9635 General Electric connected to an 8 cylinder Buffalo Gasoline engine.
1—1000 K.W. 3 ph., 60 cy., 480 volt, 3600 RPM, General Electric Generator to a General Electric turbine 180 lbs steam pressure 40 lbs back pressure.
1—300 KW, 3 ph., 60 cy., 440 vlt, 3600 RPM Westinghouse Generator only.
7—500 amp. 6 V direct current to 3 ph., 60 cy., 220 vlt. General Electric rectifiers.
1—750 KW Gen. Elec. Extraction type Turbine 3 ph., 60 cy., 600 vlt. 150-175 lbs. 10 to 20 lbs. extraction.
1—100 KW, 125 V, type CD1247 General Electric to a 150 HP 3 ph., 60 cy., 220 vlt. type K5572 Gen. Elec. induction motor.
1—50 KW, 250 volt Gen. Elec. to a 75 HP 3 phase, 60 cycle, 440 Vlt. General Electric motor.
A large number of new 115 volt direct current ball bearing General Electric motors 5 to 20 HP.
1—1500 KW, 250 vlt. 600 RPM Westinghouse rotary converter complete with transformers and switchboard.

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Immediate Delivery

2—Flynn & Emrick Series 60B with or without motors. Capacity for 250 Hp Boiler—Feeding Capacity 900# per hour—1500# Max. 15 Hp Motors 220 V 25 cyc.
1—Huber Hand Stoker For a 150 Hp Boiler.

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FOR SALE

STOKERS

1—Combustion Engineering Company Spreader Stoker with Cinder Recovery System. Capacity 36,000 pounds of steam per hour. Installed 1943 operated three years.
1—Westinghouse Underfeed Stoker, Heavy Duty, Single Retort, Link Grate, Steam Ram Drive with Wing Steam Turbine Driven Force Draft Fan, Capacity 20,000 pounds of steam per hour. Installed 1943; operated three years.

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DIESEL ENGINE GENERATORS

2—American Locomotive, 720 BHP—6 cylinder 12½" bore x 13" stroke, 630 RPM, mechanical injection, 4-cycle Diesel Engine—direct connected to: General Electric 600-KW, 240-volt, direct current, 630 RPM Generator. Complete with switchboard, motor-driven air-compressor, lubricating oil filter, lubricating and fuel oil tanks and many spare parts.

NEW 1944, USED LESS THAN 300 HOURS AND FULL EQUIVALENT OF NEW

WALTER H. WILMS & COMPANY
2526 GUARDIAN BLDG., DETROIT 26, MICH.
CAdillac 1856-1857

SLIP RING MOTORS

3-PH., 60 Cy.

HP	Volts	Make	Speed
200	2200/440	G.E.	600
150	2200/440	G.E.	600
150	440 220	Whse.	1200
125	440/220	G.E. (Hoist)	900
125	440/220	G.E.	900
100	440/220	G.E. (MTC)	900
100	550	G.E.	900
100	440/220	G.E.	600
80	440/220	G.E. (MTC)	900
75	440/220	G.E. (MTC)	600
75	440/220	G.E.	720
60	440/220	G.E.	1200
60	440/220	Cr. Wh.	720
50	2200/440	G.E.	600
50	440/220	G.E.	900
75	550	G.E.	900
40	440/220	G.E.	720

SYNCHRONOUS MOTORS

3-PH., 60 Cy.

HP	Volts	Make	Type	RPM
300	440/220	G.E.	ATI	600
300	4150/2300	Cr. Wh.	SYN.	900
250	440/220	Whse.	HR	277
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	G	G	1800
150	440/220	G.E.	ATI	900
150	2200/440	G.E.	TS	600
125	2300	G.E.	TS	327
110	440/220	G.E.	TS	1800
110	440/220	G.E.	TS	257
100	440/220/25 cy	G.E.	TS	375
100	440/220	Whse.	G	1800
90	440/220	G.E.	ATI	1200

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-132 General Electric, 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.

3—New 2500 amp., DA 75, Whse., 3 pole, air type circuit breaker, indoor

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
300	440/220	G.E.	IK	720
300	2200/440	Whse.	CS	600
250	440	G.E.	IK	400
250	550	G.E.	IK	450
200	2200/440	G.E.	KT	1200
200	440	G.E.	IK	360
200	2200/440	Whs.	CS	600
150	440/220	Howell	B. Brg.	1800
125	440	G.E.	KT	600
100	2200	G.E.	KT	511
100	440/220	G.E.	KT	720
75	2200	G.E.	IK	1800
75	220	G.E.	KT	1200
60	440/220	G.E.	KT	1800
50	550	Whse.	CS	3600
50	440/220	G.E.	FTR	900

A. C. GENERATORS

1—450 kva., 900 rpm., 440/220 v., G.E.
1—450 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 600 rpm., 440/220 v., G.E.
1—225 kva., 600 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
2— 30 kw., 1200 rpm., 440/220 v., G.E.

MOTOR GENERATOR SETS

1—100 kw., 125 v., 1200 rpm. Whse., conn. to 150 hp. 440/220 v., 3 ph. syn. motor.
1—75 kw., 250 v., 1200 rpm. Whse., conn. to 112 hp. 440/220 v., sq. cage motor.
1—25 kw., 440/220 v., 1800 rpm. G.E. alternator conn. to 40 hp. 220 v., DC motor.
1—60 kw., 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
1—35 kw., 120 v., 1800 rpm. G.E., conn. to 50 hp. 440/220 v., 60 cy., squirrel cage.

TRANSFORMERS

60 Cycle

3—200 kva. Whse. SK, 2200-244/488.
9— 25 kva. Whse., 440-115/230 v. dry new.
1—150 kva. Whse. SK, 13200-125/215 v. 3 ph.
3—150 kva. Whse. SK 11000-2300 v.
3—50 kva. Type H, 2400-240/120 v. Single phase, 60 cycle, G.E.
3— 50 kva. G.E., DRY, 460-115/230 v.
3—37½ kva. G.E., H-K, 2400-440 volts.
6— 25 kva. G.E. DRY, 2400-120/240 v.

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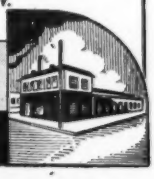

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750 HP Fulton diesel 4 cylinder, 4 cycle, 500 KW 3 phase, 60 cycle, 440 volt generator. Complete.

750 KW GE condensing turbine 3 stage, 3600 RPM 3 phase, 60 cycle, 2300 volt, surface condenser.

25 KW International UD-14 portable diesel generator set, 220 volts. Like new.

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2—General Electric 2250-KVA, 3-phase, 60-cycle, 2300 volts, 3600 RPM Generator, direct-connected to General Electric 1800-KW, 3600-RPM, 10-Stage, Condensing Turbine, 410 lbs. throttle pressure, 28 to 28.5 inch vacuum. Complete with Surface Condenser and Condenser Auxiliaries. New — 1943. Used Approximately 3200 Hours and Like New.

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75, 100, 150, 350, 400 HP Slip Rg. Motors
50, 60, 100, 150, 200 HP Sq. Cage Motors
750 KVA 2300/440 V. Gen. D/C Unaflow
100 HP, 130# W.P. Scotch Marine Boiler
D-7 Caterpillar Tractor with Bulldozer
210 KVA 440 V. Gen. D/C Skinner Unaflow
75'x104"x½" Rotary Dryer—Dbl. shell

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100 HP motor, 3-60-220/440/2300 v.
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220/440 volts, 3 ph., 60 cycle

Qu.	HP	R.P.M.	Make	Type
35	1	1800	A-C, G.E.	BB, DP— New
10	2	1200	Al. Ch.	BB, DP— New
35	3	1800	Al. Ch.	BB, DP— New
35	5	1800	A-C, G.E.	BB, DP— New
1	7½	1800	Al. Ch.	TEFC — New
10	7½	1800	L. Allis	OGX — New
2	10	530	Wagner	HS-HT — R & G
1	10	900	G.E.	SB-DP — New
7	10	1800	Al. Ch.	OBB — New
2	10	3600	Al. Ch.	OBB — New
2	10	3600	G.E.	BB, DP— R&G
3	15	1200	G.E.	BB, DP— New
2	15	1200	G.E., Wstg.	HT — New
1	15	3600	G.E.	SB, DP — New
1	20	900	Al. Ch.	OBB — New
4	20	1200	Al. Ch.	OBB — New
1	25	1200	Al. Ch.	OBB — New
2	30	1800	A-C, Wstg.	OBB — New
1	50	1200	Al. Ch.	OBB — New
2	50	1800	Al. Ch.	OBB — New
1	125	1800	Al. Ch.	OSB — New

D.C. MOTORS, 230 VOLTS, ADJUSTABLE SPEED, RECONDITIONED AND GUARANTEED (Except New Where Shown)

Qu.	HP	R.P.M.	Make	Type
1	3	1150/2815	Rel.	14-T, Shunt
2	3/5	600/1800	Wstg.	SK-50
3	3½/5½	500/1500	Wstg.	SK-60
1	3/5	1150/3450	G.E.	Type B, Shunt
2	5/7½	400/1600	Wstg.	SK
5	7½/10	450/1800	Rel.	92-T, Shunt
2	5/7½	500/2000	Rel. L.A.	Shunt
1	10	250/1000	C.C.	Type L
2	10	300/1200	G.E.	RLC-201, Shunt
3	10	500/1500	Rel.	78-TF, Shunt
2	10	550/1650	E.C.K.	Shunt
7	10/15	575/2300	G.E.	DC-85
3	11½	500/1500	Wstg.	SK
3	15/20	400/1200	G.E.	RLC203A, Shunt
1	15/20	600/1800	Rel.	131-T
3	20/25	400/1200	G.E. E-D	
7	20/25	600/2000	G.E.	CD-105
2	20/25	400/1600	G.E.	CD-113
1	30/40	400/1200	G.E.	RLC-204
2	35	500/1500	G.E.	RF13, 2 hrs 50°
3	40	250/1500	G.E.	CD-1441
2	60/75	375/1200	E.D.	25-SG
1	125/150	400/1200	Diehl	Comp., K-15
1	150	262/750	G.E.	Frame MPC

SLIP RING MOTORS

220/440 volts (except where other shown), 3 phase, 60 cycle.

Qu.	HP.	R.P.M.	Make	Description
1	1	1750	Rel.	30-min.— New (R&G)
1	3	860	Wstg.	CW, 2:1 Control, New
2	5	1800	Wstg.	CW, protected—R&G
1	15	900	Triumph	TR-10—R&G
1	15	1200	Imp.	AS—R&G
1	75	600	Triumph	C-15—R&G
1	250	600	Lincoln	2200 volts—R&G
1	400	450	G.E.	2300 volts—R&G

SPECIALS

1—250 H.P. new G.E. Synchronous motor, 720 R.P.M., 2200 volts, 3 phase, 60 cycle, mill line torques, 80% P.F.
5—Reliance 40VS drives, with 40/50 H.P. D.C. motors and complete A.C.-D.C. controls. 220/440/3/60.
18—3 KW M-G Sets, 250 volts D.C., 220/440 volts A.C., drip-proof, flat compounded.
We can furnish any A.C. or D.C. control to your specifications up to 1000 H.P., 4160 volts.

M-G SETS, RECONDITIONED & GUARANTEED (Except New Where Shown)

Qu.	K.W.	D.C.	Volts A.C.	Description
14	.8	dual	208	Wstg., 3 unit
2	.3	6	110/220	1 ph., Leland
3	3	125	440	Rel, G.E.—New
18	3	250	220/440	Nearly new
6	10VS		220/440	Rel., with motors
1	10	125	220/440	Al. Ch.—New
1	30	dual	220/440	New, 3 unit
1	30	240	220	
1	30	250	220	Rel.—New
2	60	120	220/440	Wstg.

ALSO MANY OTHER NEW AND RECONDITIONED A.C., D.C. MOTORS, 1/6 H.P. TO 150 H.P.

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(Formerly Electric Motor & Repair Co.)
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Large Stock at All Times of

AURORA CENTRIFUGALS
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AMERICAN ROTARY
BLACKMER ROTARY

Rebuilt Pumps in Centrifugals

STEAM & HIGH PRESSURE HYDRAULIC

C & S MACHINERY CO.
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Garfield 4290

TRANSFORMERS

1—250 KVA G. E. 60 cy. 1 ph. 7800—460
1—100 KVA G. E. 3 ph. 60 cy. 2300—460
12— 75 KVA New Atlantic, 60 cy., 1 ph. 2400—240/120
10—100 KVA New Atlantic, 60 cy., 1 ph. 2400—240/120
2—150 KVA. 60 cy. 1 ph. 4160—240/120

ATLANTIC TRANSFORMER CO.
TRANSFORMER SPECIALTIES
5143 N. 2nd St. Philadelphia, Pa.

MOTOR GENERATORS

Brand new. Built by Allis Chalmers to rigid specifications of the U. S. Navy.

K.V.A. output 1.250 R.P.M. 3600
K. W. output 1. Cont. Duty Ph. Single
P. F. .80 Cycles 60
Volts input 115. D. C. Volts output 120. A. C.
Amps. input .14 Amps. output 10.4

Length 26"; width 12⅞"; height 13".
Compound accumulative A. C. and D. C. fields. Centrifugal starter. Splashproof covered, frequency adjustable to load, plus or minus five cycles.
PRICE $87.50.
Identical machine, but 230 volts D.C. input $125.00.

Prices f.o.b. Tuckahoe, New York
IMMEDIATE DELIVERY
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BRONZE IRON **PUMPS** ALLOY METALS
ELECTRIC–STEAM–GASOLINE DRIVEN.
All Makes – Capacities – Pressures.
Centrifugal – Rotary – Plunger – Turbine.

MOTORS 1-2-3 PH. & D. C.
STANDARD EQUIPMENT – UP TO 200 H.P.
Generators – Welders – Dynamos.
New & Rebuilt Guaranteed Machines.

TURBO BLOWERS
SPENCER–INGERSOLL RAND–ALLEN BILLMYRE. For Heat Treating – Brazing Furnaces – Smelting – Vacuum Duty Etc.

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AIR COMPRESSORS
ALL TYPES–CAPACITIES 1 to 1000 "CFM"
Electric – Gasoline – Steam Driven.
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All Makes – All Capacities – Tested.

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CAPACITIES FROM 25 to 100000 CFM.
VENTILATING – SUCTION – BLOWING
Air – Dust – Gases – Steam Vapors.

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BOILERS

2—1047 HP Heine Boilers 200#
4—1010 HP Heine Boilers 200#
2— 786 HP B. & W. Stirling 180#
2— 750 HP B. & W. Stirling 190#
1— 650 HP Casey Hedges 225#, 1932
1— 519 HP Titusville 3 drum Boiler 200#
2— 404 HP Springfield Sec. Header Boilers 200#
3— 318 HP B. & W. Stirling Boilers 200#
4— 250 HP HRT Boilers, 200#
1— 216 HP Vogt 3 drum Boiler 160#
1— 80 HP Cyclotherm Steam Generator 125# (New)
1— 40 HP Leffel Scotch Marine Boiler 125#

TURBINES

1—750 KW Westinghouse Turbo Generator, 250# pressure, 100° superheat, 2300 volts, all auxiliaries, recently rebuilt.
1—6250 KW General Electric, 1800 RPM, Condensing, all auxiliaries.
1—750 KW 3-60-240 volt General Electric Automatic Extraction.
1—3700 KVA General Electric Condensing Turbine.
1—500 KW General Electric Condensing Turbine
1—2000 KW General Electric Condensing Turbine.

DIESEL ENGINES

1—360 KW Chicago Pneumatic—480 Volts—New.
2—100 KW McIntosh-Seymour, 3-60-2300 volts, all auxiliaries.
5—100 KW General Motors Diesel Engine Generator Sets, 110-240, D.C. new 1942.
4—300 KW General Motors Diesel Engine Generator Sets, 110-240, D.C. new 1942.

ENGINE GENERATOR SETS

1—27"x36" Skinner Uniflow, direct connected to 562 KVA AC Generator, complete.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine Generator.
1—28"x36" Hamilton Uniflow direct connected to 750 KW, 3-60-2300 volts, all auxiliaries.
1—450 KW Skinner Uniflow Engine Generator, 2300 volts, 14 years old.
1—125 KVA Skinner Unaflow Engine Gen. 3/60/240.

SPECIAL OFFERING:

1—650 HP Casey Hedges Water Tube Boiler, 225# pressure, complete with all Trim Copes Regulator, Combustion Engineering Stoker. Boiler new 1932. Available for immediate shipment.

SEE Fletcher FIRST!

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Qu.	KW	Make	Speed	D.C.V.
1	750	G.E.	1200	600
1	500	Whse.	1200	600
1	400	G.E.	1200	275
1	300	Whse.	1200	600
1	300	Burke	900	250
1	175	Whse.	1200	275
1	125	G.E.	1200	275

TRANSFORMERS

1—200 KVA Kuhlman, Cont. Duty, Auto. 3800-2300/3/60.
3—37½ KVA Pitts. Cont. Duty, Auto. 6900-2300/1160.

MOTORS

1—80 HP. 1200 RPM, Cr. Wh. 220/440/3/60 Ind.
1—75 HP. 1800 RPM. U. S. Line Start 220/440/31 60 Ind. B.B.
1—65 HP. 1200 RPM, G. E. type KT. 220/440/3/60 Ind.
1—40 HP. 900 RPM, Whse. type CW, 440/3/60 Slip Ring.
5—5 HP. 2200 RPM. Reliance Ex. Proof, 230 V. D. C.
Several Whse. type SK, 230 V. D.C.
5, 7½, 10 and 15 HP. New TEFC and standard open ball bearing AC motors available. Across line and reduced voltage starters.

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NEW and REBUILT

MOTOR GENERATOR SETS
Complete with Control Equipment
2—150 KW, 900 RPM, 250V, DC. to 225 HP 2300V. A.C. Syn.
2—150 KW, 900 RPM, 600V. D.C. to 225 HP 2300V. A.C. Syn.

TURBO ALTERNATORS
Complete with Auxiliaries and Control Equipment.
1—3650 KVA 3600 RPM, 2300/3/60, Whse.
1—3125 KVA 3600 RPM, 2300/3/60, Whse.

FOR SALE

DETROIT ROTO STOKER

1 New, unused stoker. Designed for 600 HP B & W boiler. Guaranteed 200% rating. Three 27" rotors, 13 x 9', stationary grates, complete for installation. Purchasing power reason for selling.

GOODMAN LUMBER CO.
Goodman, Wisconsin

DIESEL GENERATOR UNIT
1500 H.P.—1250 KVA
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Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM, All Accessories, Complete
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SPECIAL OFFERING

3—4300 Gal. Morris Centrifugal pumps, single stage, 240 ft. head, 1750 RPM, 14 in. sus., 12 in. dis., type TS-12H, direct connected to 300 HP Crocker Wheeler squirrel cage motor, 3 ph., 60 cy., 2200 V. New 1940.

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CUT TO SKETCH ⅛ to 24"
METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
LARGE SURPLUS STOCK
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10 to 1000 H.P.
NEW-USED RECONDITIONED
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SKINNER ENGINE

One—19" x 20" Skinner Counter Flow Engine 150# Throttle Pressure, 15# Back Pressure. Can be Inspected in Operation.

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Newton Falls, New York

FOR SALE

2—Engine driven generators, 2300 v., 325 KVA Allis-Chalmers and 460 KW G.E. Details on request.

2—400 HP. Foster Marine Boilers, 260# operating pressure.

1—750 KW, 250 volt D.C. Generator, direct connected, single bearing.

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SPECIAL

450# 720° F.TT. GENERAL ELECTRIC TURBO-GENERATORS Immediate Delivery

WITH NEW (Never Used) SURFACE CONDENSERS And NEW Condenser Auxiliaries

1—5000-KVA. General Electric, 450#-psi., 720° F.TT., 3/60/480-Volts

2—2815-KVA. General Electric, 450#-psi., 720° F.TT., 3/60/2300-Volts

Slightly Used. For Service Guaranteed Same as New Machines

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1—American Marsh vac. pump steam driven #187586—Type A.M. vac. size 8"-12"-12"

1—Union steam pump duplex #143146—size 7-½"-4"-6"

1—Warren steam pump duplex—size 7-½" x6"x10

1—Bailey fluid meter Type C-6 #27545—chart #60C-6 designed for water at 212°

3—Worthington pumps duplex steam driven

#864824W
#864822W
#1030108
} 5-¼"x3½"x5" #MM133-89-127

have been used for pumping #6 fuel oil

1—Warren pump #7526—size 2" Type ZH-B-10 capacity 150 gal. per minute at 400 ft. head driven by Carling turbine size R-3500 r.p.m. 30 H.P. Type 16 C #6262 150 lbs. steam

1—Warren pump #2392—size 1-½" Type Z-H-B capacity 100 gal. per minute at 392 ft. head speed 2500 r.p.m. driven by Terry Turbine #13023 Type YL H.P. 21 steam pressure 150 lbs.

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FOR SALE

1—250 KW GE turbo-generator unit, Steam conditions 525#, 350° superheat, condensing. Generator 3-phase, 60 cycle, 450-volts, 1200 RPM with 40 KW exciter.

Machine New in 1941

G. DeROSE
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FOR SALE
150 H.P. low pressure
CYCLO-THERM BOILER
Gas and/or oil burner, complete, ready for operation. Built 1946, used 30 days. Condition excellent. Selling because too small for our plant. Address inquiries
E. A. CREGO, IROQUOIS CHINA CO.
SYRACUSE, N. Y.

FOR SALE—STOKER

Ind. Anthracite Stoker, 60 HP—8000 sq. ft. steam-size for boiler furnace 48" long by 40" wide with moving grate surface for automatic discharge of ash. Complete with hopper load and controls mounted on steel panel board.

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One No. 20 Iron Fireman Pneumatic Spreader Stoker
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Diesel & Gasoline - Driven
5 KW to 700 KW - AC or DC

International Harvester and Chicago Pneumatic engines driving G.E. or Electric Machinery Co. generators.

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FOR SALE
GENERATOR AND STEAM ENGINE

One Crocker Wheeler, 80 KW, DC Generator, with extra armature and extra field regulator. One 50 H.P. Troy Engine, Type TP. Immediate inspection and delivery.

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1—No. 300MS, ASME Lookout Heggie-Simplex High Firebox Mechanical Fired Type Boiler for oil firing; SHBI rating 36430 sq. ft. steam; Heating Surface 2183-9 sq. ft.; Furnace Volume 506.2 cu. ft.; complete with regular equipment (Manufactured by Lookout Boiler & Manufacturing Company, Chattanooga 1, Tennessee.)

Price f.o.b. Elba, Alabama $3300.00

1—Vertical Condensation Unit manufactured by Chicago Pump Company, 40,000 sq. ft., Total Dyn. Hd. 15#, Basin Depth 3 ft., Impeller dia. 6½" complete with 1—1½ hp. 3 phase Motor, R.P.M. 1750, 60 cycle, 220 volts, plus 1 Standard Float Control on 15" Stand, 1—36"x3 ft. Deep Vertical Receiver, 1—Auto X Line Started, UNMTD.

Price f.o.b. Elba, Alabama $225.00

This material is new and unused, never installed.

DORSEY TRAILERS, Inc., Elba, Alabama

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3—3000 KVA—Whse.—sgl. ph. 60 cy.—22,000 pri. to 2450/4250 Y sec.—OISC—truck mtd.—outdoor type—std. tap changes, etc.

3—50 KVA—Pittsburg—sgle. ph.—60 cy.—11,500 pri. to 460 volts sec.—OISC—outdoor type—std. tap changes.

LEHIGH ENGINEERING CO.
Deposit & Savings Bank Building
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STARTERS
ACROSS THE LINE. AUTOMATIC
For synchronous motors 200 H.P. and 250 H.P. 3-60-4150.
GUYAN MACHINERY COMPANY
LOGAN, W. VA.

BOILERS

EXCEPTIONAL OFFERING—PRICED FOR QUICK SALE to make room for larger equipment.

1—489 H. P. Heine Box Header Water Tube Boiler complete with Suspension Steel, Hand Fired Grates, All Catalogue Trimmings—Extra Equipment. Re-tubed in 1940. ASME, National Board and Pennsylvania Standard, 165# W. P.

2—300 H. P. Oil City (Heine Type) Water Tube Boilers, complete with Suspension Steel, Hand Fired Grates, All Catalogue Trimmings—Extra Equipment. Retubed in 1940. ASME, National Board and Pennsylvania Standard, 165# W. P.

These are exceptional Boilers and are now under active Certificate. Inspection can be made at any time.

2—100 H. P. Titusville Economic Type Firetube Boilers, ASME and New York Standard, 150# W. P. All Catalogue Trimmings, New Grates for Coal Firing or Burner Front for Oil Firing. Completely overhauled and in fine condition.

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507 Fifth Avenue Murray Hill 7-6547 New York 17, N. Y.

DIESEL ENGINE GENERATORS

1—Waukesha 15-KW, 80% P.F. 127/220V 3 phase, 60 cycle, slightly used

1—Buda, 30-KW, 80% P.F. 127/220V, 3 phase, 60 cycle, NEW

2—Buda 30-KW, 80% P.F. 127/220V, 3 phase, 60 cycle, slightly used

WALTER H. WILMS & COMPANY
2526 Guardian Bldg. Detroit 26, Mich.

FOR SALE
STOKERS

Two 9' x 11' Harrington Chain Crate Stokers, capable of carrying two 600 horsepower boilers, complete with forced draft fan and vertical reciprocating engine 8 x 8. Completely dismantled and ready for immediate shipment.

MIDWEST MFG. COMPANY
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CONDENSER TUBING

BRASS, COPPER NICKEL, ADMIRALTY, ALUMINUM BRASS
⅝" OD & ¾" OD
New, Prime, Government Surplus
40% BELOW MILL PRICE

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53,600 C.F.M.—#13 American Sirocco, ¼" Resistance Pressure @ 124 R.P.M. Belt Drive, 15 H.P. Motor Required. 86" Inlet, 78" x 62" Top Horiz. Dis.

IN PHILA. STOCK—Immediate Shipment

DELTA EQUIPMENT CO.
148 N. 3d St. Phila. 6, Pa.

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STEAM ENGINE

Right Hand Corliss Steam Engine 800 to 900 horsepower wheel approximately 16-ft. diameter by 30-inch face. Engine size 24x48. Cylinder has been rebored with junk ring and new snap packing ring. Have spent approximately $2000.00 to recondition. Will sell for $3200.00. Can be seen at

CROGHAN MILLS, INC.
CROGHAN, NEW YORK
TELEPHONE—CROGHAN 2861

DIESEL GENERATOR SETS
GENERAL MOTORS DIESEL, 12 Cylinder, Model 12/567, 2 cycle, 720 RPM. Direct connected to 600 kw 500 volt DC Westinghouse generator. Like new. In stock.

ALJOHN DIESEL CO., Inc.
904-10 Pacific St., Brooklyn 16, N. Y.
Sterling 3-6515

ENGINE GENERATOR SET
250 KW Croc. Wh. D.C. Genl., Com. Interpole, 125 V. 2000 Amp. 150 RPM. D.C. to Erie Ball high speed non-releasing gear Corliss Eng., 4 valve eng. #6772, size 24 x 27, 100# pres. new 1925. Good con.

PHILA. TRANSFORMER CO.
2829 Cedar St., Phila., Pa.

For Immediate Sale
BOILERS

Two Erie City 250 H.P. Type #3 HWT Boilers, Designed for 180 lbs. Pressure, now equipped for Oil firing, complete with gauge columns, steam pressure gauges, safety valves, non-return and blow-down valves; also soot blowers and one boiler equipped with Super-Heater. Each boiler 10'8" wide, 20'8" long, 19'9" high, 48" drum diameter. Boilers now in use but can be shipped in August.

BUFFALO ELECTRO-CHEMICAL COMPANY, INC.
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Each issue is only part of the complete service we are organized and glad to render to reader and advertiser, alike. We want you to consider this publication your primary source of information in this field.

POWER 330 West 42nd St., New York

Rebuilt Power Transformers

SINGLE PHASE—OISC

28— 3 KVA Whse. 6000 to 115/230 (new)
3—50 KVA G. E. 33000 to 2300 V.
5— 100 KVA G. E. 22000 to 220/110 V.
6— 200 KVA Whse. 11000 to 440/220 V.
2— 400 KVA Al. Ch. 66000/2300/4000 Y.
6— 500 KVA G. E. 13200 to 575 V.
6— 500 KVA Whse. 24000 to 220/110 V.
3— 667 KVA Pack. 11000/22000 to 440 V.
8— 667 KVA G. E. 33000 to 440/220 V.
2—1200 KVA Whse. 66000/2300/4000 Y.
2—2000 KVA Whse. 66000 to 2200 V.
3—2000 KVA G. E. 13200/26000 to 2300 V.
3—2000 KVA Whse. 33000 to 11000 V.
3—2000 KVA G. E. 33000 to 13200/6600 V.
7—4000 KVA G. E. 15950/27600 Y to 13800/6900/4160 V.

THREE PHASE

3— 450 KVA G. E. 66000 Y to 440 V.
6— 650 KVA G. E. 13200 to 2300 V.
1—1200 KVA Whse. 6600 Y to 2300 V.
2—1500 KVA G. E. 13200 to 440 V.
3—1800 KVA G. E. 13200 to 550 V.
1—3000 KVA G. E. 11600 to 440 V.
1—15000 KVA Pitts. 27880 to 4560Y. V.

WATER COOLED-SINGLE PHASE

4—3333 KVA G. E. 25/60 Cy. 6000 to 4000/6925Y 8000/13850
3—1500 KVA Al. Ch. 33000 to 13200/6600 V.
7— 750 KVA Whse. 33000 to 2200 V.
7— 675 KVA Whse. 33000 to 2200 V.

PYRANOL

1—3000 KVA Penna. 25 Cy. 13800 to 480 V. 3 Ph.
19—37½ KVA Penna. 440 V. to 220 V. 60 cy. 3 ph.

NETWORK TRANSFORMERS

19—150 KVA G. E. type Ht, late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Vault or submersible type; attached to each transformer is G. E. automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.
8—200 KVA G. E. Ditto

STATION-TYPE REGULATORS

4—68 KW indoor type Westinghouse constant current regulators, Type R.S., Prim 2200 V., 60 cy., Amp. 6.6 & 7.5 Serial Number 582020

PHILADELPHIA TRANSFORMER CO.

2829 Cedar St. Phila. 34, Pa.

Steam Engine with alternator direct connected 100 K.W. 220 volt 3 phase, 60 cycle.

2 Babcock & Wilcox straight tube boilers 150 and 200 H.P.

Motors, 3 Phase 60 cycle 220 Volt, 1140 and 1750 RPM. All sizes, ½ to 30 H.P. New and used.

Aluminum Corrugated Roofing, new Condensers, 2000 and 1000 sq. ft.

B. C. SKINNER MACHINERY CO.

DUNEDIN, FLORIDA, Telephone 8-511

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

LARGE STOCK OF A.C. and D.C. MOTORS!

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
1	3	1750	440*	West.	CW-232C
1	5	580	220*	G.E.	HI-9
6	7½	810	550	G.E.	MTC-5201
1	7½ (new)	575	220*	G.E.	MT-522
2	10	1140	440*	West.	HF-7A
2	10	570	220*	G.E.	HI-11
3	11‡	810	550	G.E.	ITC-5008
1	15‡	900	440*	G.E.	MTC-5302
2	15	570	220*	West.	CW-646
1	18	680	440*	West.	MW-316
1	25	1130	550	G.E.	MT-323
2	25	850	220*	Wagner	BR
2	25	720	440*	Wagner	22VBR
1	30	865	440*	West.	CW-646
1	30	850	440*	G.E.	MT-332
1	30	675	440*	G.E.	MT-336
2	35	600	440*	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440*	G.E.	MT-346
1	50	860	440*	West.	HF-12A
5	52‡	550	220*	G.E.	IQC-5013***
1	60	685	440*	West.	CW-758
1	60	570	550	G.E.	MTC-5516
1	60	345	550	West.	CW
1	75	720	550	G.E.	MT-556
1	80‡	575	440*	G.E.	MTC-5352
1	100	1760	220*	Al.-Ch.	ARY-223BS
2	125	430	440*	G.E.	IL-16
2	150	1750	440*	G.E.	MTP-549
1	150	720	2200	G.E.	I-M
1	150	385	550	G.E.	IM-17
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
3	250 (new)	360	440	West.	CW-20-53-15
3	300	900	440*	G.E.	IM-17
1	300	514	550	G.E.	IM-17A
1	400	505	550	West.	CW
1	700	720	2300/4000	West.	CU

*Can be furnished for either 220 or 440 volts but not both voltages.
‡Intermittent rating.

230 VOLT CONSTANT SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	T-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
2	7½	875/1750	West.	SK-63L
3	7½	850	G.E.	CD-75
5 (new)	10	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10 (new)	12½	600	West.	SK-93
5	15	825	West.	SK-90
3	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	750	G.E.	RC
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	650	G.E.	RC-16
2	60	1750/1310	West.	SK-143
3	75	850	West.	SK-160
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

VARIABLE VOLTAGE DRIVES

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP. 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220*	Reliance	AA-B3247
2	20	1160	440*	West.	CS-554
1	25	1140	2200	West.	CCL
1	25	705	440*	West.	CS-W504-TEFC
1	25	690	440*	G.E.	KT-336
1	30	870	220*	West.	CS-646
1	30	1160	440*	West.	CS-644
1	50	900	2200	G.E.	KT-346
1	50	850	220*	West.	CCL
1	75	1750	2200	West.	CS-761
1	100	1765	2200	West.	CS-765A
2	100	870	440*	G.E.	KT-356
1	100	690	220*	West.	C.
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	150	1800	440*	Howell	N-684
3	150	1175	2300‡	G.E.	KTP-557
2	200	1750	440*	West.	CS-855S
4	200	580	550‡	G.E.	KT-566S
4	350	1750	2300	G.E.	K-559
1	500	1200	440*	G.E.	KTP-567

*Can be furnished either 220 or 440 volts, but not both voltages. ‡Reconnectable for 440 volts.

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	1½/2	500/200	G.E.	CD-65
1	2	225/900	Reliance	78T
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	G.E.	RF-10
1	12½	280/840	West.	SK-130
10 (new)	12½	600	West.	SK-93
1	15	600/1800	Reliance	T-131T
1	15/20	500/1500	G.E.	CD-95
1	20	400/1600	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	25	500/1500	Reliance	T-230T
1	30	400/1200	West.	SK-163
1	35	500/1500	West.	SK-143
3	40/50	400/1600	Al.-Ch.	EB-147
3	40/50	400/1600	Reliance	T-385T
1	75	500/1500	Cr-Wh.	CCM
1	75	375/750	Cr.-Wh.	CMC-125H
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/750	West.	SK-220
2	375	350/500	G.E.	MPC

CRANE, MILL TYPE, 230 V. D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1 (new)	10	650	G.E.	MD-403-BE
2	10	690	West.	K-4
1	13	575	G.E.	CO-1806
1	15	630	West.	K-5
2	20	515	West.	K-6
3	25	590	Diehl	TE
2	27	490	West.	MC-40
2	35	750	G.E.	CO-1828
3* (new)	35*	600	West.	CK-9
1	50	750	G.E.	CO-1829A
1	50	600	West.	CK-9
5** (new)	50**	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831AE

*Available with West Type DW Frame 135F. Style 487555, Shunt Wound Brakes.
**Available with G.E. CR9523B313M2. Cat 823043-G24 Shunt Wound Brakes.

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SQUIRREL CAGE, BALL BEARING
1800 RPM, 3 Phase, 60 Cycles
220/440 Volts

Qn.	HP	Make	Type
15	1	G.E.	K-203
15	2	G.E.	K-224
15	3	G.E.	K-225
15	5	G.E.	K-254
10	7½	Al.-Ch.	AR-284
7	7½	G.E.	K-284
6	10	G.E.	K-324
2	20	G.E.	K-364

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Atttention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

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Crane 57'3" Span
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P&H 37' Span

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ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues

Air Preheater Corp. 277
Air Transport Ass'n of America for Railway Express Co. 162
Ajax Flexible Coupling Co. ..... *
Aldrich Pump Co. 242
Allen-Sherman-Hoff Co. ..... *
Allis-Chalmers Mfg. Co. .34, 43, 197, 203
Alloy Steel Products Co. ..... *
Allpax Co. 196
American Blower Co. 236
American Brass Co. 129
American Chain & Cable Co. 208, 315
American Chimney Corp. .....
American District Steam Co. 150
American Engineering Co. 35, 153
American K.A.T. Corp. 192
American Manganese Steel Div. ..... *
American Metal Hose Branch..... *
American Pulverizer Co. 191
Ames Iron Works..... *
Anchor Packing Co. 179
Anderson Co., V. D. 149
Arkansas Fuel Oil Co. ..... *
Armstrong Cork Co. 260
Armstrong Machine Works.....100-101
Asbestos Textile & Packing Div. Raybestos Manhattan, Inc. 157
Atlas Valve Co. ..... *
Automatic Control Co. ..... *

Babbitt Steam Specialty Co. 222
Babcock & Wilcox Co. 4-5
Babcock & Wilcox Tube Co. ..... *
Badger & Sons, E. B. 287
Bailey Meter Co. 14-15
Baldwin-Hill Co. ..... *
Baldwin Locomotive Works..... 300
Bartlett Hayward Div. Koppers Co. 219
Bartlett & Snow Co., C. O. 258
Beaumont-Birch Co. 164
Bell & Gossett Co. 268
Belmont Packing & Rubber Co. 200
Betz Co., W. H. & L. D. 233
Biddle Co., James G. 154
Birch Mfg. Co. 318
Bird-Archer Co. ..... *
Black, Sivalls & Bryson Co. 177
Blaw-Knox Co. 319
Boiler Tube of America..... 308
Boston Woven Hose & Rubber Co. 247
Brady Co., W. H. 224
Brickseal Refractory Co. ..... *
Bridgeport Brass Co. 303
Brooke Engrg Co. ..... *
Brooks Boiler Treatment Co. 216
Bros Boiler & Mfg Co., Wm. 292
Brown Instrument Co. 171
Buell Engineering Co. 170
Buffalo Forge Co. 297
Buffalo Pumps, Inc. 58E
Bussmann Mfg. Co. 22-23
Byers Co., A. M. 62
Byron Jackson Co. 255

Cabot, Inc., Samuel..... 216
Canton Stoker Co.....58B-58C
Carbide & Carbon Chemicals Corp..... 318
Carborundum Co. 56-57
Cardox Corp. 310
Carey Co., Ltd., Philip..... 185
Cash Co., A. W..... 270
Cash Valve Mfg. Corp., A. W..... *
Chapman Valve Mfg. Co..... 151
Chase Brass & Copper Co..... 195
Chicago Metal Hose Corp..... 174
Chicago Pneumatic Tool Co..... 248
Cities Service Oil Co..... *
Clarage Fan Co..... 280
Clark Mfg. Co..... 234
Cleaver-Brooks Co. ..... *
Cochrane Corp. 178, 261
Coffin, Jr. Co., J. S..... 181
Combustion Engrg. Co.....40-41
Condenser Service & Engrg. Co..... *
Coppus Engrg. Corp..... *
Corning Glass Works..... 188
Crane Co. 131
Cryer Trap & Valve Co..... *
Cutler-Hammer, Inc. 119
Cyclotherm Corp. 275

Dampney Co. of America..... *
Darling Valve & Mfg. Co..... 291
Dart Mfg. Co., E. M..... 158
Davis Engrg. Corp. 288
Davis Regulator Co. 182
Dayton Rubber & Mfg. Co..... 240
Dearborn Chemical Co..... *
De Laval Separator Co..... 229
De Laval Steam Turbine Co.....58H, 216
Deming Co. 206
Detroit Stoker Co. 283
Diamond Power Specialty Corp..... 8-9
Dixon Crucible Co., Jos..... 214
Dodge Mfg. Corp..... 274
Dowell, Inc. 221
Dravo Corp. 143
Drew & Co., E. F..... 238
Dunham Co., C. A..... 212

Eagle-Picher Co. 266
Edge Moor Iron Works, Inc..... *
Edward Valves, Inc..... 125
Electric Fish Screen Co..... *
Electric Machinery Mfg. Co..... 263
Electric Storage Battery Co..... *
Elgin Softener Corp..... *
Elliott Co. 6-7, 169
Engineer Co. 267
Enterprise Engine & Foundry Co..... *
Ernst Water Column & Gage Co..... 302

Fairbanks, Morse & Co..... 231
Fairfield Engrg. Co..... 358
Fairmont Coal Bureau..... *
Flexitallic Gasket Co..... *
Foster Engineering Co..... 317
Foster Wheeler Corp..... 46
Foxboro Co. 244
Frick Co. ..... *
Fuller Co. 172

Gardner Denver Co..... 276
Garlock Packing Co..... 232
General Coal Co. ..... *
General Controls Co. 312
General Electric Co., (Apparatus Dept.) 24-25, 167
General Electric Co. (Appliance & Merch Dept.) 55
Gifford-Wood Co. 245
Globe Steel Tubes Co..... *
Golden-Anderson Valve Specialty Co.... 281
Goodyear Tire & Rubber Co..... *
Goulds Pumps, Inc..... *
Green Fire Brick Co., A. P..... 211
Greene, Tweed & Co..... 237
Grinnell Co.....3rd Cover
Griscom-Russell Co. 285
Gulf Oil Corp. 215
Gulf Refining Co. 215
Gunite Concrete & Construction Co..... 220

Haering & Co., D. W..... *
Hagan Corp. 10-11, 161
Hahn Equipment Corp..... 302
Hall Laboratories 58F-58G
Haynes Stellite Co..... 199
Hays Corp. 30-31
Hays Institute of Combustion..... 224
Heacon, Inc. ..... *
Helicoid Gage Div., American Chain & Cable Co. 208
Hendrick Mfg. Co..... 304
Henszey Co. 202
Hewitt Rubber of Buffalo, Div. of Hewitt Robins, Inc.....58-58A, 305
Hill Pump Valve Co..... 318
Hoffman Specialty Co..... 210
Homestead Valve Mfg. Co..... 286
Honan-Crane Corp. 301
Hoppes Mfg. Co..... 314

Ideal Industries, Inc..... 310
Illinois Water Treatment Co..... *
Infilco, Inc. ..... *
Ingersoll-Rand Co. 42, 205
International Nickel Co..... 58D
Iron Fireman Mfg. Co.....28-29

Jefferson Union Co..... 176
Jeffrey Mfg. Co..... 217
Jenkins Bros. 136-137
Jerguson Gage & Valve Co..... *
Johns-Manville, Inc. 141
Johnson Corp. 318
Jones Foundry & Machine Co., W. A.... *
Joy Mfg. Co. (Sullivan Div.)..... *

Keasbey & Mattison Co..... 226
Kellogg Co., M. W..... 279
Kennedy Valve Mfg. Co..... 298
Kennedy-Van Saun Mfg. & Engrg. Corp. 16-17
Kewanee Boiler Co..... 188
Koppers Co. 219
Kuljian Corp. 168

Ladish Corp. 173
Laminated Shim Co..... *
Leeds & Northrup Co.....Second Cover
Leslie Co. 321
Le Tourneau, Inc., R. G.....36-37
Lincoln Electric Co..... 252
Linde Air Products Co..... 299
Link-Belt Co. 3
Liquid Conditioning Corp..... *
Liquidometer Corp. 321
Lovejoy Flexible Coupling Co..... *
Lubriplate Div., Fiske Bros. Refining Co. *
Lummus Co. 272
Lumnite Div., Univ. Atlas Cement Co.. *
Lunkenheimer Co. 52-53

Madden Co., P. E..... 176
Manhattan Rubber Div., Raybestos Manhattan, Inc. ..... *
Manheim Mfg. & Belting Co..... *
Manning, Maxwell & Moore..... 321
Marley Co., Inc..... 159
Marlow Pumps, Inc..... 312
Marsh Corp., James P..... 309
Mason-Neilan Regulator Co..... 264
McGraw-Hill Book Co..... 308
Mercoid Corp. 146
Midwest Piping & Supply Co..... 265
Minneapolis-Honeywell Regulator Co... 249
Modine Mfg. Co..... 259
Mortell Co., J. W..... 204
Murray Iron Works Co..... 220

National Airoil Burner Co..... 314
National Aluminate Corp. 135
National Supply Co. 243

National Tube Co. ..... •
National Valve & Mfg. Co. 241
Niagara Blower Co. 180
Nicholson Co., W. H. 204
Nordberg Mfg. Co. 32–33
Northern Equipment Co. 139
Norton Co. 296

Oakite Products, Inc. 178
Ohio Injector Co. 207
Orr & Sembower, Inc. 262
Otis Elevator Co. 294

Pacific Pumps, Inc. 189
Parker Appliance Co. 290
Peerless Pump Div. 192
Penflex Sales Co. 307
Penn Salt Mfg. Co. ..... •
Permutit Co. 214, 273
Philadelphia Gear Works 230
Pipe Fabrication Institute 223
Pittsburgh Piping & Equip. Co. 311
Powell Co., Wm. 26–27
Powers Regulator Co. ..... •
Prat-Daniel Corp. 271
Preferred Utilities Mfg. Co. 222
Pritchard Co., J. F. 194

Quaker Rubber Co. ..... •

Raybestos Manhattan, Inc. 157
Reading, Pratt & Cady Div. 315
Reeves Pulley Co. 235
Reliance Electric & Engrg. Co. ..... •
Reliance Gauge Column Co. 193
Republic Flow Meters Co. 20–21
Republic Rubber Div., Lee Tire & Rubber Corp. 282
Republic Steel Corp. 44–45
Research Corp. ..... •
Revere Copper & Brass, Inc. 133
Rhoads & Sons, J. E. 256
Richardson Scale Co. ..... •
Ric-Wil Co. ..... •
Ridge Tool Co. 302
Riley Stoker Corp. 96–97
Robins Conveyors, Inc., Div. of Hewitt Robins, Inc. 58–58A, 305
Rockbestos Products Corp. 289
Roebling's Sons Co., J. A. ..... •
Roper Corp., Geo. D. 148
Roto Div., Elliott Co. ..... •
Rust-Oleum Corp. 304

Sarco Co. 187
Schramm, Inc. 152
Schutte & Koerting Co. ..... •
Scovill Mfg. Co. 50–51
Shaw Co., B. F. 213
Sier-Bath Gear & Pump Co. ..... •
Simplex Valve & Meter Co. ..... •
Sinclair Refining Co. 165
Skinner Engine Co. ..... •
Sloan Valve Co. ..... •
Smith Refractories, Sanford C. .....
Smooth-On Mfg. Co. 312
Socony-Vacuum Oil Co. ..... Back Cover
Springfield Boiler Co. 39
Square D Co. 183
Squires Co., C. E. ..... •
Standard Oil Co. of Calif. 257
Standard Oil Co. of Indiana 155–156
Standard Pressed Steel Co. 220
Steamaster Automatic Boiler Co. 209
Steel & Tubes Div. 44–45
Stephens-Adamson Mfg. Co. 145
Stickle Steam Specialties Co. 160
Stock Engineering Co. 184
Stone & Webster Engrg. Co. ..... •
Strong Carlisle & Hammond Co. 246
Struthers-Wells Corp. ..... •
Sturtevant Co., B. F. ..... •
Sun Oil Co. 123
Superior Combustion Industries 253
Superior Engine Div. 243
Sweet's Catalog Service 306
Syntron Co. 310

Taylor & Co., W. A. 186
Taylor Forge & Pipe Works ..... •
Taylor Instrument Co's 284
Terry Steam Turbine Co. 269
Texas Co. 12–13
Thermix Corp. 271
Thread Rolling, Inc. 318
Tidewater Associated Oil Co. 225
Timken Roller Bearing Co. 227
Todd Shipyards Corp., Combustion Equipment Div. ..... •
Toledo Pipe Threading Machine Co. 250
Trane Co. 278
Troy Engine & Machine Co. 190
Tube Turns, Inc. 147

Union Carbide & Carbon Corp. ..199, 299, 318
Union Chain & Mfg. Co. ..... •
U. S. Steel Corp. ..... •

Viking Pump Co. 196
Vogt Machine Co., Henry 251

Waldron Corp., John ..... •
Wallace & Tiernan Products, Inc. 254
Walworth Co. 295
Warren Steam Pump Co. 228
Watson-Stillman Co. ..... •
Webster & Co., Warren 127
Western Chemical Co. ..... •
Westinghouse Electric Corp. 60–61
Weston Electrical Instrument Co. 218
Wheeler Mfg. Co., C. H. 313
Where to Buy 318
Whiton Machine Co. ..... •
Wickes Boiler Co. 239
Wiedeke Co., Gustav ..... •
Wiley & Sons, Inc., John 218
Williams Gauge Co. 166
Williams & Co., J. H. 304
Wilson, Inc., Thomas Co. ..... •
Wing Mfg. Co., L. J. 224
Worthington Pump & Machy Corp. .38, 47, 48–49, 54, 163, 175, 201
Wright-Austin Co. 198
Wrigley Jr. Co., Wm. 306

Xzit Sales Co. 186

Yarnall-Waring Co. 18–19, 121
Youngstown Sheet & Tube Co. 293

Zallea Bros. & Johnson ..... •
Zernickow Co., O. 318

PROFESSIONAL SERVICES 320

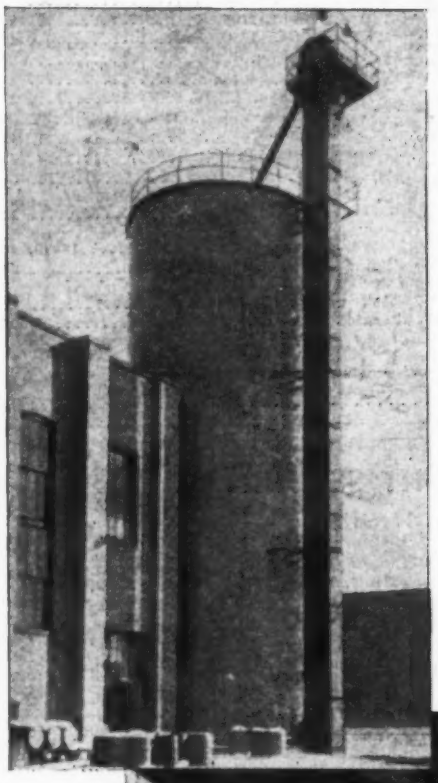
SEARCHLIGHT SECTION

(Classified Advertising)

CLASSIFICATION PAGE
POSITIONS VACANT 323
SELLING OPPORTUNITIES 323
POSITIONS WANTED 324
WANTED TO PURCHASE 324
BUSINESS OPPORTUNITIES 324
LEGAL NOTICES 324
USED EQUIPMENT 325, 354
EQUIPMENT WANTED 324, 355

A-C Supply Co. 347
Aljon Diesel Co., Inc. 350
American Air Compressor Corp. 348
American Nickeloid Co. 352
Archer & Baldwin Inc. 346
Atlantic Transformer Co. 347
Bauer, L. W. 355
Belyea Co., Inc. 325
Berger Bros. Elec. Motors Inc. 353
Brealey, H. P. 354
Brew, Woltman & Co., Inc. 342
Brewing, C. H. 354
Buffalo Electro-Chemical Co. 350
C & S Machinery Co. 347
Carnival Art Corp. 352
Chicago Electric Co. 343
City Electrical Service & Equipment Co. 344
Commercial Sales, Inc. 352
Crogham Mills, Inc. 350
Crowley, I. J. 349, 352
Cusac & Associates, F. L. 353
Darien Corp. 353
Delta Equipment Co. 350
DeRosa, G. 349
Diesel Motors Corp. 335
Dolphin Jute Mills 349
Dorsey Trailers 349
Duquesne Electric & Mfg. Co. 340
Eagle Signal Corp. 352
Ebasco Services Inc. 349
Economy Co., Inc. 353
Electric Apparatus Repair Co. 344
Electric Equipment Co. 348, 324
Electric Generator & Motor Co. 351
Electric Motor & Repair Co. 347
Electric Service Co. 355
Electronicraft, Inc. 347
Ellis Co., A. Lee 342
Erie Electric Co., Inc. 343
Evans Products Co. 355
Fletcher Sales Co. 348
General Electrical Equipment Co. 354
Glamorgan Pipe & Foundry Co. 349
Globe Ticket Co. 352
Glow-Electric Co. 337
Goodman Lumber Co. 348
Gulf Dredging Co., Inc. 352
Guyan Machinery Co. 350
H & P Machinery Co. 346
Hall & Co., Stephen 346
Heat & Power Co., Inc. 330
Hemphill & Co., Inc., J. L. 327
Howe Bros. 336
Hunt, Inc., C. V. 354
Industrial Trading Co. 346
International Power Machinery Co. 331
Iron & Steel Products, Inc. 353
Iroquois China Co. 349
Johnson & Associates, Howard Blaine 344
Kerns, F. L. .....
Keystone Power Plant Equipment Co. 345
Kiemle Co., Fred W. 344
Kirk Co., Wallace E. 342
Land & Co., L. J. 329
Lehigh Engineering Co. 350
Locke Co., C. B. 348
Louis Machine Co., Edward 354
McNeil Laboratories Inc. 349
M & R Detelic Laboratories Inc. 349
Mail Photo Service Inc. 353
Maryland Glass Corp. 345
Metropolitan Plumbing Sup. Co., Inc. 345, 348
Midwest Mfg. Co. 350
Mississippi Valley Equipment Co. 346
Motor Repair & Mfg. Co. 345
National Electric Service Co. 348
Neu Corp., Hugo 338
Newton Falls Paper Mill, Inc. 348
Ohio Valley General Hospital 324
Osmer, John L. 352
Penn Elec. Engineering Co. 345
Penn Machinery Co. 344
Percival R. Moses & Assoc. 324
Philadelphia Transformer Co. 348, 350, 351
Power Equipment Co. 344, 355
Power Plant Equipment Co., Inc. 351
Power Plant, Nebraska Wesleyan University 324
Rearick, Charles B. 344
Sabin Metal Corp. 350
Schoonmaker Co., Inc., A. G. 341, 348, 353
Skinner Machinery Co. 351
Sonders Electric Equip. Corp. 354
Stanhope, L. M. 354
Stewart & Co., Inc., Paul 332
Sundfelt Equip. Co., Inc. 334
Superior Equipment Co. 347
Thompson Co., Inc., J. Parker 348, 350, 355
Utilities Electrical Machinery Corp 328
Vem-Severin Machine Co. 352
Villasyso Bros. Co., Inc. 353
Volland Elec. Eq. Co., Inc. 340
Wadhams & May Co. 349
Wagner & Co., Arthur 326
Weaver & Co., Charles 339, 349
Wente Electric Co. 333
Wilms & Co., Walter H. 345, 350
Wurth Electric Motor Co. 346
Zenith Transformer Co. 355

Fairfield DESIGNS · · · BUILDS · · · ERECTS EQUIPMENT TO MEET YOUR POWER PLANT NEEDS



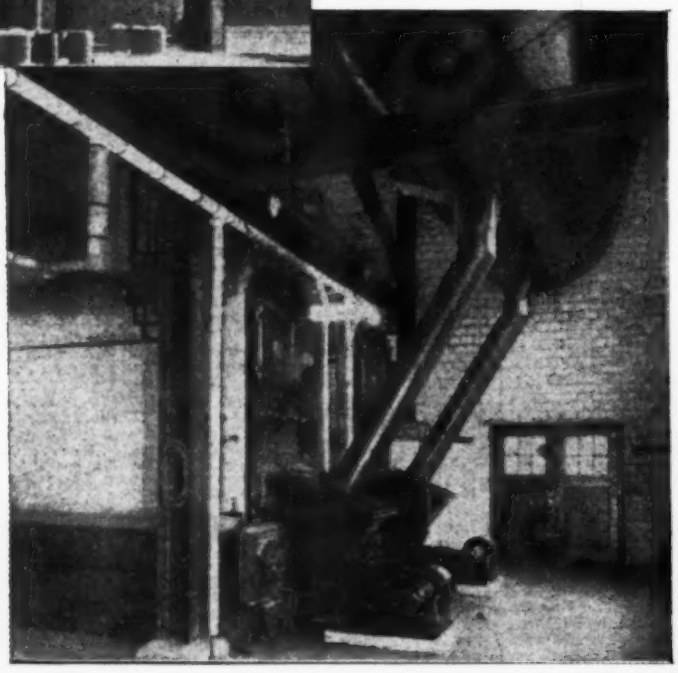
• Fairfield is essentially an engineering organization to the extent that each job is designed—built—and erected to meet the particular needs of your present plant or to fit in with a new plant's specifications.

The circular silo, shown upper left, of vitrified glazed tile, is designed with air channels providing insulation in freezing weather and does not absorb moisture. As more critical materials are being released we can now give you steel bunkers, depending upon your job requirements. The coal elevating equipment used is generally a bucket elevator or a skip hoist. A weigh larry or conveyor delivers coal to stokers or pulverizers in most instances.

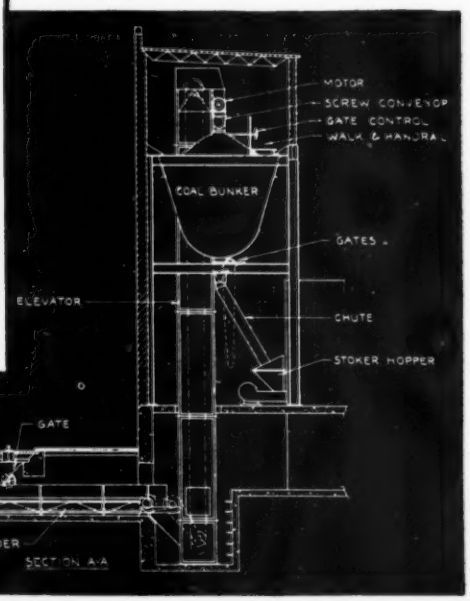
To the left is shown a suspension bunker with chutes to deliver coal to stokers. The bunker is usually located inside the power house as shown here and filled by a horizontal distributing conveyor. This system is used quite frequently where there are a number of boilers to be fed.

BELOW.—A 100-ton steel suspension bunker with chutes to stokers.

Diagram showing equipment used to deliver coal to 100 ton, steel suspension bunker, consisting of an apron feeder, bucket elevator, distributing screw conveyor and chutes to stokers.



If yours is a coal or ash handling problem consult a Fairfield representative for an engineered system from the ground up. Designed, built, erected by one organization for satisfactory service and ultimate economy. Write for complete information.



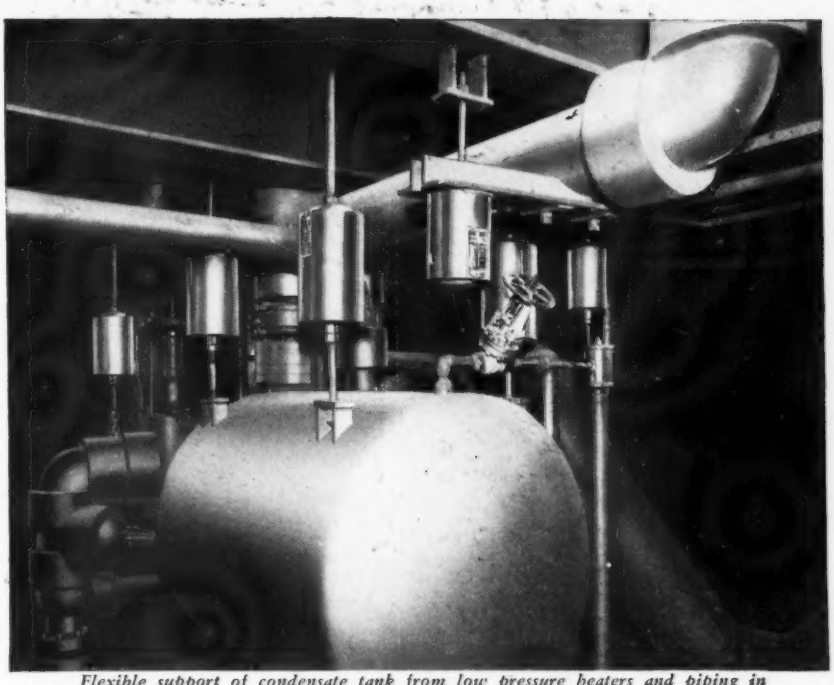
THE FAIRFIELD ENGINEERING CO.

Builders of Coal and Ash Handling Equipment

320 CHICAGO AVENUE · MARION, OHIO

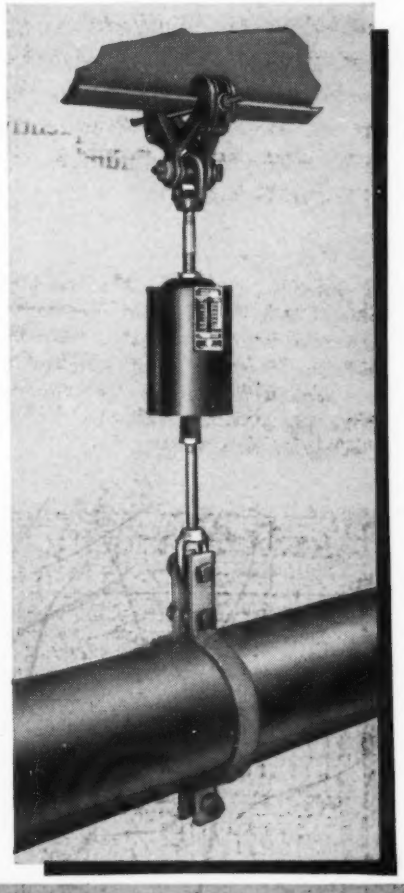
FLEXIBLE SUPPORT OF PIPING

made easy for you



Flexible support of condensate tank from low pressure heaters and piping in Consolidated Edison's Hell Gate Station.

with GRINNELL PRE-ENGINEERED SPRING HANGERS



FLEXIBLE support of piping subject to thermal movement is now a simple matter for you – just select a stock Grinnell Pre-Engineered Spring Hanger that exactly meets the load requirements.

After computing the load it is easy to select the proper size of hanger from a simple capacity table. The 14 sizes include a load range from 84 lbs. to 4700 lbs.

LOOK AT THESE FEATURES . . .

- The maximum variation in supporting force per ½" of deflection is 10½% of rated capacity – in all sizes.
- Guides prevent contact of coils with casing wall or hanger rod and assure continuous alignment and concentric loading of spring.
- Compact – minimum headroom made possible by precompression*
- Precompression* assures operation of spring within its proper working range where variation in supporting force is at a minimum.
- All-steel welded construction meets pressure piping code.
- 14 sizes available from stock – load range from 84 lbs. to 4700 lbs.
- Easy selection of proper sizes from simple capacity table.
- Installation is simplified by integral load scale and travel indicators.
- Unique swivel coupling provides adjustment and eliminates turnbuckle.

**Precompression is a patented feature*

Write for descriptive folder on Pre-Engineered Spring Hangers Fig. 268.

GRINNELL COMPANY, INC.
Executive Offices: Providence 1, R. I.

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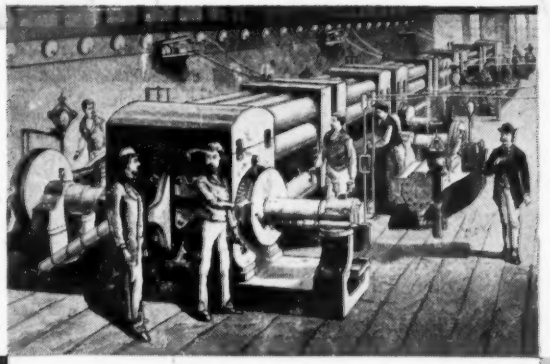
GRINNELL

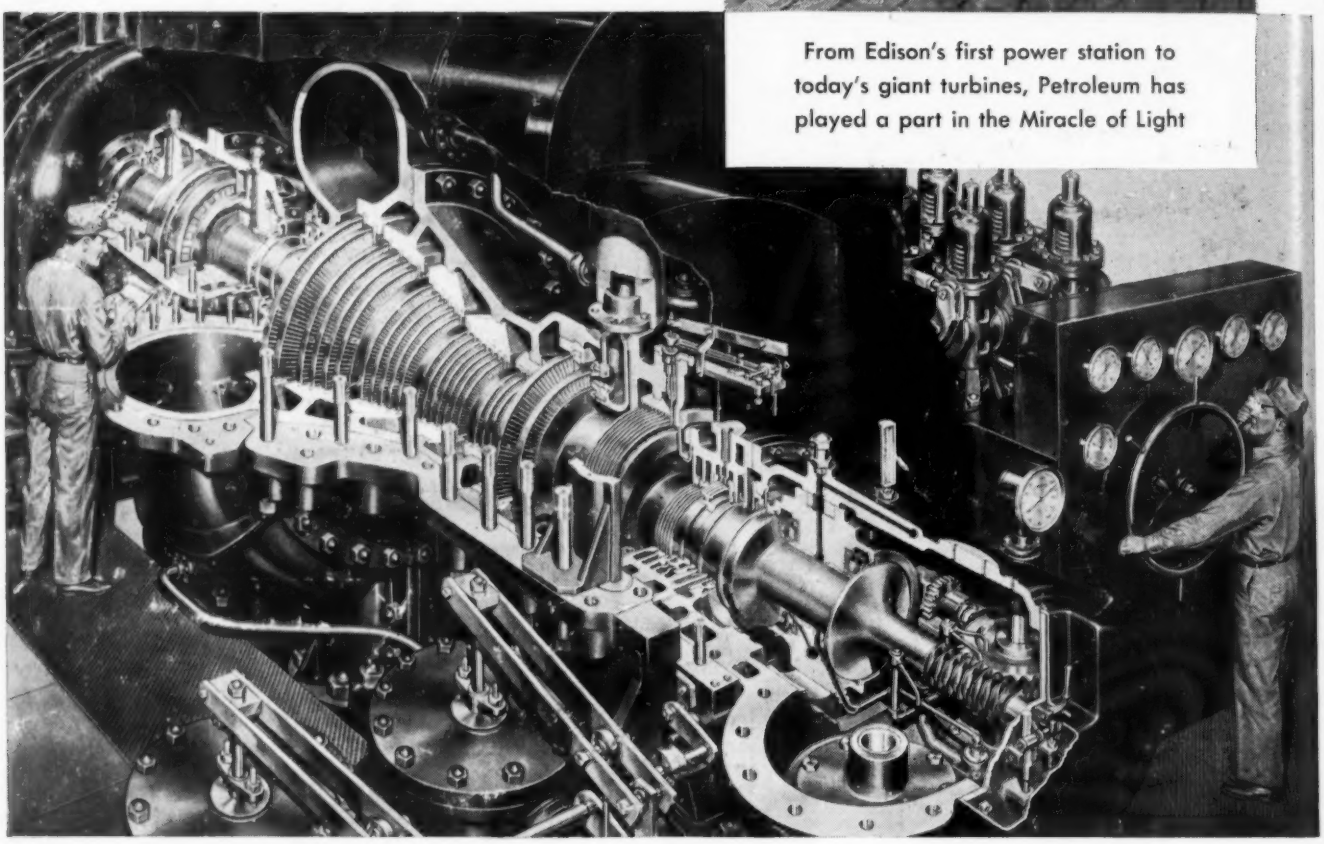
FOUNDED 1850

WHENEVER PIPING IS INVOLVED

It's Still a Miracle!



From Edison's first power station to today's giant turbines, Petroleum has played a part in the Miracle of Light



They called it a miracle in 1882, when Thomas Edison set up the first central power station. He used special Gargoyle oils to protect the steam engines and dynamos shown above.

Today, this miracle of light and power is still unfolding. Giant steam turbines (like the one cut open above) are pouring out hundreds of times the energy of Edison's first machines. And now, as in the beginning, special Gargoyle oils are meeting the stepped-up pressures and temperatures of these modern power plants.

Through the years, Socony-Vacuum's Correct Lubrication Service to industry has kept pace with industry's own ever-broadening service to the public. The producers of power as well as those who operate machines, have learned to call upon Socony-Vacuum for the latest in lubricants, backed by 81 years' experience in the petroleum industry.

SOCONY VACUUM OIL CO., INC., and Affiliates:
Magnolia Petroleum Company, General Petroleum Corp.

81 Years of Leadership in a Progressive Industry

SOCONY-VACUUM CORRECT LUBRICATION

SOCONY-VACUUM

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